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PUBLISHER'S NOTE

Since the publication of the Gynecological and Obstetrical Monographs, definite advances have been made in some fields, while in others time has only served to modify, more or less definitely, views and practices heretofore held.

Such changes are inevitable and altogether desirable. Progress is reflected, whether in the form of new additional features or in the discard of the old.

The authors of the various monographs have, at the request of the publisher, furnished the material which brings the subject matter of each volume of the series up to the present. The material is presented to the profession in this supplemental volume.

The manifest convenience of an index covering the entire series has prompted the preparation of the Composite Index, comprising the second part of this volume, which includes adequate references to the supplementary material as well.

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STERILITY AND CONCEPTION

SUPPLEMENTARY CONTRIBUTION

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STERILITY

Introduction.—*Involuntary sterility*, believed to affect anywhere from one marriage in ten to one in six, ranks high as a social problem, and receives increasing attention as a major medical responsibility. Theories of causation and treatment, accepted earlier, are now questioned in the absence of supporting data in which clinical impressions are reënforced by carefully evaluated observations and statistical analyses based upon well-recorded case histories of the male as well as the female partners. Until recently even painstaking reports made on long series of sterile marriages have concentrated upon the wives and omitted a correlated study of the husbands, which has greatly diminished their significance.

At present, diagnosis and, to a less extent, treatment are aided by available means of measuring male fertility, as, for example, the counting of defective sperm-cells and the systematic postcoital observation of sperm-cell migration in the female tract; also newer methods of determining tube patency and crippled function due to rigidity, adhesions and stricture, such as the use of graphs. Early and effective care of endocervicitis is of prime clinical importance.

Current clinical and laboratory studies of promise in the field of sterility include: Histology, biochemistry, physiology and pathology of the sperm and spermatogenesis; the application to the human of biological studies of the estrum and ovulation cycles, particularly those relating to the female sex hormone and the time of ovulation; and the chemistry and bacteriology of the vagina and cervix.

Based upon a recent analysis of cures and failures in over 300 cases, all with correlated semen examinations, the curability of sterility (with azoospermia cases omitted) stands at about 33 per cent. With gross tubal cases declined, sterility was relieved in 47 per cent of the patients who persisted in treatment (*J Am. M. Ass.*, Jan. 1, 1927, p. 7).

Causes.—The literature on sterility abounds with studies of etiology and some figures on the relative frequency of causes are given. In the woman,

blocked tubes are stated as the most frequent cause of sterility by practically all writers, with a variance in frequency ranging from 25 to 66 per cent. Chronic endocervicitis and underdevelopment with congenital or acquired dysfunction of the ovary, make up the two next largest groups, but here again great discrepancy is noted. The accuracy and value of statistics may be questioned unless correlated semen examinations and other data necessary to a complete survey of the cases are published. It is important to know if the occurrence of any one lesion is given as the major cause in a stated series or if the figures represent the maximum frequency without regard to coexisting lesions. In 236 cases Dickinson found a single cause in only 6.8 per cent, while 13 per cent had three or more possible existing causes or an average of approximately two causes to each patient. For example, in 100 completely studied cases, with analysis of insemination findings in all, retroversion was found to play little part in influencing the migration of sperm-cells to the fundus, and while backward displacement of the uterus was found as a complication in 18 per cent of these cases, it is not listed as a major cause in any. Also, in our series, salpingitis, or blocked tubes, was noted in 35 per cent of the cases, but with azoöspermia and hopeless semen cases subtracted, it occurs as a major lesion in 25 per cent. An incidence of appendicitis in 16 per cent of 502 tabulated sterility cases was noted by Dickinson and Cary. The former in 24 studied cases found closed tubes in all of 6 unoperated cases and stenosed tubes in 8 of 18 operated cases, and the latter reported 7 blocked tubes in 22 cases, 4 after appendectomy, and 3 after appendectomy and one-sided salpingectomy.

If, however, one compares a series of clinic cases with those from private practice, one will find that the conditioning factors vary in incidence in the two groups.

On page 3 is given an analysis of 302 cases taken from private practice and grouped as to the main defect in the woman with correlated semen findings.

Male Responsibility.—The examination of the semen as a routine and essential part of the gynecological study of sterility patients had not been stressed nor undertaken until recent years. In 1916, the junior writer described the lesser degrees of semen deficiency and suggested that if these defects were taken into account, the husband would be found more frequently at fault in sterile marriages than was commonly supposed. The frequency of male responsibility for sterile unions has been amply confirmed by reports of later observers, the average in 1763 reported cases, recently collected, standing at about 31 per cent. Hunner, in the longest series of men, found defective semen in 20 per cent, but makes the pertinent observation that the figure is doubtless too low, as men who believe themselves at fault are inclined to refuse examination. About one-third of defective semens are due to azoöspermia and very few offer opportunity for improvement, though they should have competent genito-urinary review, while a large percentage of the less deficient group may be benefited by competent care. Dabney and others state the fact, ignored by many physicians and high-grade laboratories, that the finding of a few viable spermatozoa does not indicate a semen of fecundating vigor, and stress

		Cases	Per Cent
Male responsibility		82	27.2
Azoöspermia 31	Endocervicitis	11	
	Underdevelopment	6	
	Retroversion	2	
	Obesity	2	
	Salpingitis	3	
	Fibroid uterus	3	
	Normal	4	
Deficient semen.....50	Salpingitis	8	
	Endocervicitis	14	
	Underdevelopment and amenorrhea	10	
	Retroversion	6	
	Obesity and scant period	3	
	Oöphoritis	1	
	Fibroid uterus	1	
	Normal	7	
Impotence 1			

	Semen				
	Good	Fair	Deficient		
Chronic salpingitis	49	15	12	76	25
Chronic endocervicitis	46	18	8	72	23.8
Underdevelopment, anteflexion and amenorrhea	35	10	6	51	17
Obesity with endocrine imbalance	2	..	..	2	0.7
Failure of male entrance	6	..	..	6	2
Fibroid uterus	2	2	..	4	1.6
Pinhole os cervix	..	2	..	2	0.7
No cause found	..	..	..	5	1.6
Artificial impregnation (cause not definite)	..	..	..	2	..

the importance of studying the general condition of both husband and wife. Moench is interested in determining if an index of semen deficiency may be found by accurately measuring the heads of three hundred spermatozoa and noting the percentage of these cells in which there is a variation from the normal. Estimation of semen vigor requires experience and study and must still depend primarily upon a careful collection of the specimen, with accurate observation of the gross amount, normal sperm-cell content, and the vigor and persistence of sperm-cell motility. This work is more effectively done by the gynecologist trained in examination of the semen as a correlated part of the sterility examination than by the urologist or laboratory. With rare exception, long trial of treatment, painful examinations or operative procedures upon the wife primarily for the cure of sterility before the fecundating efficiency of the husband is established, should be condemned.

Endocrine Imbalance.—The study of the endocrins in their relation to sterility is still in an indefinite stage, both as regards diagnosis and treatment. That this subject offers much for the future is best exemplified by the work of Frank who has demonstrated the sex hormone in the blood and has elaborated a method of quantitative determination. Therapeutic application may be hoped for. Controversy exists over the efficacy of ovarian therapy: *e.g.*, Frank believes it to be without potency, while Graves states that he has secured cures by the use of ovarian residue. Many writers support each view. Pottenger considers the genital function stimulated by ovarian, pituitary, thyroid,

and suprarenal secretions and diminished by the thymus and at times by the thyroid. Ovarian hypoplasia and hypo-activity leading to sterility are generally caused, in his opinion, by underaction of the thyroid or pituitary and, sometimes, adrenals. Frank states that patients may be divided into two groups as to their endocrine balance and designated as plus or minus. The minus class, he states, show slow reflex response, sluggish demeanor, slow and regular pulse, dry skin and steady hands. Infantilism documents itself by childish figure, contracted bony pelvis, shortening of the vagina and hypoplasia of the cervix. The fundus of the uterus responds so readily to ovarian activity that its size may not be taken as a guide unless observed over a long period. The size of the breasts he regards as inconclusive evidence. Stimulation of the reproductive power of these patients is not definitely assured by any therapeutic agent although thyroid extract may be used with benefit in some instances. Stimulation of ovarian action by use of the x-ray he feels should be avoided in cases of amenorrhea in which obesity exists, as the margin of safety appears especially small. Several writers discuss the relation between obesity and sterility and the ovary is thought to be at fault in these patients. Dickinson has reported 61 cases, in all of which the male was also carefully studied, and a review of his tabulated histories shows, in all but 4 instances, ample explanation for sterility in the way of poor semen, closed tubes, marked endocervicitis, or other defects.

Diagnostic Methods.—The most important test in the investigation of a sterility problem Hühner believes to be one devised by himself which is described as follows: Examination of sperm-cell activity in the cervical mucus is made as soon as possible after coitus. With a bivalve speculum the cervix is brought into view and some of the mucus is sucked by a pipet from the cervical canal and immediately expelled on a slide and examined under the microscope. The presence of numerous active spermatozoa is positive evidence of semen efficiency. If only dead sperm-cells are found, a condom specimen is examined and, if with evidence of poor semen, the male responsibility is established. On the other hand, the finding of a vigorous male specimen indicates that the female secretions destroyed the viability of the spermatozoa. Cary agrees in the importance of this examination, but believes that the value of Hühner's suggestion may be greatly enhanced by a more elaborate and standardized method of postcoital examination, which he calls an insemination test. Definite methods of preparation are carried out which involve at least twenty minutes' rest in the reclining position by the woman after coitus. She is instructed not to visit the toilet before reporting at the office, which she must be near enough to reach in forty minutes. By this technic it is thought the semen will be retained longer, thus permitting longer bathing of the cervix with the specimen, and a more satisfactory invasion of the cervical canal mucus by the spermatozoa. The examination begins one hour after coitus. In a vagina of normal length and retentive power, a definite vaginal pool, averaging about 2.5 c.c. is usually found at the time of examination. The greater the amount retained the more accurate will be the qualitative test of the male element. Mucus is next removed from the external

cervical os, then from the midsection of the canal, and finally with the lower canal wiped clean, mucus is obtained from near the internal os. Under normal conditions, the migration of the sperm-cells to the internal os is in active process at the end of an hour. The degree of sperm-cell activity in the vaginal pool, as compared with that in the cervical mucus, frequently gives valuable information. Not infrequently, also, vigorous sperm activity in the vagina and in the mucus at the cervical entrance will be found to fail entirely at the higher levels, thus demonstrating changed conditions of the mucus not evident to the eye. All apparatus used in the examination is warmed to body heat.

Fallopian Tube Patency.—By methods devised to determine the patency of the oviducts great progress has been made in one of the most troublesome features of sterility diagnosis. The method most popular and one which has received the most attention in literature is that devised by Rubin. (For description of both apparatus and technic see monograph by Rubin in this series.)

The test is carried out by a transuterine insufflation of gas to determine the patency or stenosis of the fallopian tubes and when used in properly selected cases is performed with practically complete freedom from harmful effects. Like other new methods of technic its use has been abused by those unqualified to determine its indications and by improper interpretation. Patients with gross infections in the cervical canal and tubes have had peritonitis thus induced.

Interpretation.—Pressure findings, fluoroscopic examination, and shoulder pain give the data from which conclusions are drawn. The first is the most important, and from it one may conclude that tubes are freely open when gas passes into the abdomen at a pressure of 100 or less. If more than 100, but less than 150, definite conclusions cannot be drawn regarding the condition of the tubes, and further investigation by other methods must be used. Only 13 per cent of 600 cases tested by Aldridge fell into this class, which he regards as the indefinite group. A pressure of about 150 Mm. points to definite obstruction in one or both tubes, and when the mercury remains at 200 without a drop, the test may be concluded and the tubes regarded as in a state of total occlusion. In normal cases in the upright position the gas can be seen as a light area beneath the diaphragm when the case is examined fluoroscopically. However, passage at low pressure combined with shoulder pains or discomfort is proof enough of the presence of gas in the abdomen, and the only advantage of the fluoroscope is in those cases where a drop in pressure is not followed by pain. Shoulder pain is usually present in normal cases, and is probably due to the irritation of the phrenic nerve-endings in the upper peritoneum, to which the gas rises; if carbon dioxid is used, it disappears by absorption in about an hour's time.

Cary first presented the feasibility of determining tube patency by the transuterine route and began with x-ray study of the distribution of opaque fluid and has sponsored the fluid method since. The fluid used is 1 dram of a freshly made 15 per cent sodium iodid solution. Three pictures are taken; one before the installation of the iodid solution and two immediately after for stereoscopic study, which greatly aids detailed interpretation. In patients with

known occlusion of the tubes, the pictures may be taken while the solution is kept under pressure, thus demonstrating the point of stenosis. Details of technic to be emphasized are the warming of the solution to body-temperature and the avoidance of spasm by omitting the use of tenacula upon the cervix (which is found unnecessary), and the use of gentle pressure (20 Mm.) at the beginning of injection. Utilizing the proper pipet facilitates the work. Three pipets, each of 1 dram capacity, with slight variation in the tip to snugly fit different types of cervical canals, comprise the apparatus. These are made of heavy Jena glass tubing and are very resistant to breakage. The method has the attraction of simplicity and of causing no discomfort to the patient. Reaction of any degree is very rare. The same procedure is used for the injection of 10 per cent solution of argyrol before laparotomy, the color of the argyrol being observed through the wall of the tube, definitely showing the operator the point of stenosis. Other solutions have been used by other investigators. The same pipet, equipped with a 30 c.c. capacity bulb and with a manometer attached to the right-angled projection, may be used for the test of patency with carbon dioxid or air. Cary noted rather severe air reactions in about 10 per cent from no more than 15 c.c., but Dickinson never saw a reaction from air, using 15 to 30 c.c. When using carbon dioxid, the gas is sucked within the pipet from the rubber tubing leading from the gas container. A sterile solution is introduced through the bivalve speculum covering the point of contact between cervix and pipet, a possible leak of air which would cause erroneous interpretation being at once disclosed by the expulsion of gas bubbles. Furniss and Seides have other simple methods of using air. Shoulder pain is not obtained if the air is held within a sacculated tube. Negative tests should be repeated. The use of iodin and oil solution has been brought into popularity by reason of the darker shadow obtained in the x-ray study, and Rubin has recently presented the results of some very interesting observations thus made upon the peristalsis of the tubes, but issues a definite warning by reporting unhappy results in 4 of 50 cases in which lipiodin was thus used.

Several modifications of both methods have been devised. Kennedy has contributed results of very valuable study with the fluid method. He used a 20 per cent solution of sodium bromid for his test and reports twice as many closures at the fimbria as at the isthmus, and considers the method of value in determining the position of the tubes, the presence of dilatation and the location of strictures. Dickinson uses a glass cannula connected by a T with a portable manometer and a bulb of 20 c.c. capacity. Several others mention insufflation of the tube from the fimbriated end at the time of operation to demonstrate patency.

Indications.—By many the testing of tubal patency is not considered an office procedure, and certainly its general use by those unfamiliar with the technic should be discouraged. While in careful hands testing tubal patency may in general be stated as harmless, caution in use is emphasized by many. Some cases of postpatency-test peritonitis are reported in improperly selected cases. Moench (1927) reported 2 deaths recorded on autopsy by the New

York medical examiner as due to an embolus after insufflation. Sellheim refers to a death from a similar cause (Engelmann) and an emphysema of the abdominal wall (Mandelstamm) in another patient who recovered. McGlinn reports 3 instances of ruptured tubes. Lehmann's specimens, their tubes clamped after complete hysterectomies, showed no ruptures, but emphysemas of the broad ligament at 250 to 350 Mm. The examination should be timed midway in the menstrual cycle so that the endometrium will be in a quiescent stage, as the congested endometrium may occasionally give rise to tubal stenosis and a resultant false diagnosis. Tests made within two or three days after the conclusion of the period also would prevent a possible interruption of an unexpected pregnancy. Conditions of acute or subacute inflammation of the cervix or tubes are distinct contra-indications for the test. In the hands of the expert, patients with previous tubal involvement long quiescent may be studied, but even with most careful selection of cases secondary infections occasionally occur.

Errors are doubtless common in the results obtained from tube patency tests. Open tubes when determined under pressure are not an assurance of physiological patency. Geist has shown how such errors may be due to unusual distortion of the interstitial portion of the tube. His study was made upon specimens of the uterus and tubes immediately after their removal by operation.

Prevention.—Some contributions have been made on this subject, among which may be mentioned that by Macomber. Of practical importance is the fact that two of the most common sources of sterility in the female are subject to some definite control; namely, gonorrheal infections transmitted from latent and symptomless foci in the male, and tubal involvement following induced abortions by which the first pregnancy is often terminated as a temporary means of birth-control. Very valuable studies in fertility and contraception are being pursued by the Committee on Maternal Health in New York. In their report, the Sterilet, more commonly used in Germany, and the "wishbone" intra-uterine stem are condemned as dangerous contraceptive devices. Bichlorid of mercury as an irritant chemical destroying the natural bacterial protection of the vaginal secretions is warned against. Objection to the Mensinga pessary is obviated by the newer method of instructing the patient in placing the pessary which is worn only at night and then removed for cleansing. With rare exception, other contraceptive methods were found to bear no causative relation to sterility.

Treatment.—The treatment of sterility is determined by the causative factors demonstrated in the individual case. Well-standardized methods for relieving gynecological conditions encountered have been elsewhere described. The success of treatment will depend, therefore, not so much on the choice of method as upon the proper application of treatment as indicated by a diagnosis both accurate and complete. It is important to recognize that lesions termed "minor" and "major" by the usual classification may be entirely reversed in importance when considered in relation to the function of fecundation. Minor conditions, any one of which may only inhibit or delay impregnation, may prevent conception when occurring several together. To

correct a major lesion for the cure of sterility without consideration for the possibly less obvious but equally important coexisting lesion not only results in frequent failure, but is usually ill-advised. Empirical operative procedures such as the curet, the stem and insufflation or injection of tubes for x-ray should be condemned not alone because they offer no reasonable expectation of success but because instrumental invasion of the uterus or the peritoneal cavity may add lesions which seriously complicate a problem previously less formidable. Husbands with less degrees of semen defects should have the advantage of urological care and the general health of both husband and wife should be considered an important factor in establishing fertility.

If the appreciation of minor causes of sterility amenable to office management be not prejudiced by the presence of major, though possibly innocent, lesions which are subject only to surgical correction, the indications for operations solely to relieve sterility will be measurably reduced, and an analysis of reliable reports of cures in reported operative series should compel a conservative statement of prognosis. This applies especially to laparotomy for closed tubes.

Great tact must be exercised in advising patients with intense desire for children, for the acceptance of the operation with moderate hope may give them the consolation of having omitted no possible chance for success, and statements implying hopelessness of cure are only justified by absence of organs, long-persistent fixation and adhesions.

Blocked Tubes.—The major sterilizing lesion in the female continues most unyielding to surgical attack. Taking the figures of eighteen operators, including Halban's 0, Pozzi's 3.3 and Polak's 6.3 per cent, and those reported by Funck-Brentano and Plauchu—the majority reporting about 10 per cent of success—we reach an average of 14 per cent curability. Gellhorn states that in his 8 successes in 40 cases he in no instance opened the abdomen primarily to open occluded tubes.

Operative relief of sterility due to anteflexion and presumptive stenosis averages about 1 in 3. In the absence of habitual amenorrhea and other stigmata of underdevelopment, simple dilatation seems as effective as plastic operations upon the cervix. Holden had 27 per cent success by each method, and Brickner, who reported 31 per cent of cures by the Dudley split, is equaled by Pozzi and Barnsby with the lateral splits, while Hunner exceeds both with 35 per cent of success by the simpler procedure. For anteflexion with small uterus and amenorrhea or oligomenorrhea, we have in clean cases used dilatation and the Baldwin stem with 33 per cent of cures in a small series. Surgical correction of uncomplicated retroversion is rarely indicated because *per se* it is infrequently causative of sterility, and pessary replacement suffices to straighten the occasional kinked tubes and restores normal broad-ligament circulation. The easily lifted uterus we have found to be rarely complicated by closed tubes though closure was found in all our fixed retroversions. Hunner-Wharton, with 19 replacements and 13 suspensions, had 25 per cent of pregnancies, and Polak, with pessary in 11 cases and suspension plus the Dudley split, had success in over half his cases. A choice of suspension operation which does

not kink the tube by drag of the closely attached round ligament is an important point in technic.

The severer cases of endocervicitis preventing pregnancy and not amenable to cautery and other office treatment should, in selected cases, be subjected to the Sturmdorf tracheloplasty, according to a recent report (not yet published) by Sovak from Holden's clinic. In a long series, 66.5 per cent of patients, where pregnancy was possible, became pregnant after the Sturmdorf coning, and 40.5 per cent of those conceiving had not previously been pregnant. Polak favors amputation of the grossly diseased enlarged cervix. Dilatation of the cervix thoroughly under anesthesia and cautery application within the canal has relieved symptoms of endocervicitis, but pregnancy has not followed in our experience with the severer cases.

Reynolds and Macomber report that surgery of the ovary is the most important feature in the treatment of sterility. This opinion has not been generally supported. In a personal communication Macomber states the technic to include freeing of the adnexa, splitting the ovary and readjustment of position.

Artificial Impregnation.—While occasional successes in relieving sterility by artificial impregnation are reported from various sources, there are no figures as to the number of trials. Nürnberger reports 7 successes by five reporters, mostly for types of male impotence. Successful injection was noted from eight to twenty-seven days after menstruation and he concludes it should be done three times in the intermenstrual cycle. Additional indications, in our opinion, are certain types of cervical stenosis. About 10 minims of normal semen drawn up very carefully in a pipet warmed to body-temperature will suffice, when slowly injected through the cleansed cervical canal, to flood the fundal cavity, where it should be gently maintained for five minutes. Dickinson, with a few more minims of semen, deliberately injects the specimen until colic-like pain in the tubal region indicates direct tubal insemination.

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MENSTRUATION AND ITS DISORDERS

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In selecting for presentation in this supplementary chapter the more important contributions which have been made during the past five or six years in our knowledge of the general subject matter of this volume, an effort will be made to follow somewhat the same sequence as in the original chapters. In this way the reader can readily correlate any of the original chapters with the subjects treated in the present supplement. It may be added that only such matters have been included as might be expected to have an effect on the general complexion of the volume. An exhaustive review of the literature for even the past few years would scarcely be possible within the limits of even a very long chapter.

Periodic Sexual Phenomena in the Lower Animals.—Much of our knowledge of the physiology of menstruation has come, and more will undoubtedly come in the future, from the study of the corresponding process in the lower animals. Such investigations are being carried out by many investigators, and two or three contributions may be mentioned as especially important. The method suggested by Stockard and Papanicalaou in 1917, whereby the stages of the sexual cycle can be so easily and so accurately determined by the study of vaginal smears, has proved to be of inestimable value and has come into quite general use. The original demonstration was made upon guinea-pigs, but since then other investigators have extended the observation to a number of other laboratory animals. The value of such a simple method of study is apparent when one bears in mind that in most of these animals there are practically no signs of estrum to be seen in the external genitalia.

The recent contributions of Allen, Doisy, and their coworkers upon the hormone of the ovarian follicle have excited much interest. They find that the subcutaneous injection of liquor folliculi and extracts of the ovarian follicles of swine brings about in spayed mice changes exactly similar to those of estrum. They report experiments which would indicate that the follicular hormone is responsible for estrous growth and secretion, sex instinct, and the attainment of puberty. They were unable to confirm the results of Herrmann, who had previously reported somewhat similar results from the lipoid principles prepared from the corpus luteum. The investigations of Allen and Doisy are extremely suggestive, although it is too soon to conclude that the follicular hormone is the all-important element produced by the ovary. This matter is further discussed in the paragraph on The Ovarian Factor Concerned in Menstruation.

Is There a Loss of Uterine Mucosa at the Time of Menstruation?—Since the writing of this monograph, the author has undergone a decided change of opinion with regard to the changes occurring in the endometrium during menstruation. The postmenstrual, interval, and premenstrual charac-

FIG. 1.—ENDOMETRIUM JUST BEFORE MENSTRUATION, TAKEN FROM A PATIENT ABOUT TO MENSTRUATE, BUT NOT YET BLEEDING AT TIME OF OPERATION

The dilated tortuous glands, the intact surface epithelium and the marked infiltration of the lymphocytes and polymorphonuclears may be seen.

teristics of the endometrium are quite well established, but there has in the past been much difference of opinion as to the changes occurring during the bleeding phase. This applies especially to the question of whether or not any considerable portion of the uterine mucosa is lost at this time. Schröder's view that there is an extensive casting off of the mucosa during menstruation has never obtained general acceptance in this country, as one may learn by a glance through even the recent editions of our textbooks on gynecology and

obstetrics. A recent study by the author, in association with TeLinde, has convinced us that there is characteristically a definite loss of tissue at menstruation. Our findings may be summarized as follows:

Our material consisted of 12 uteri removed during some phase of actual

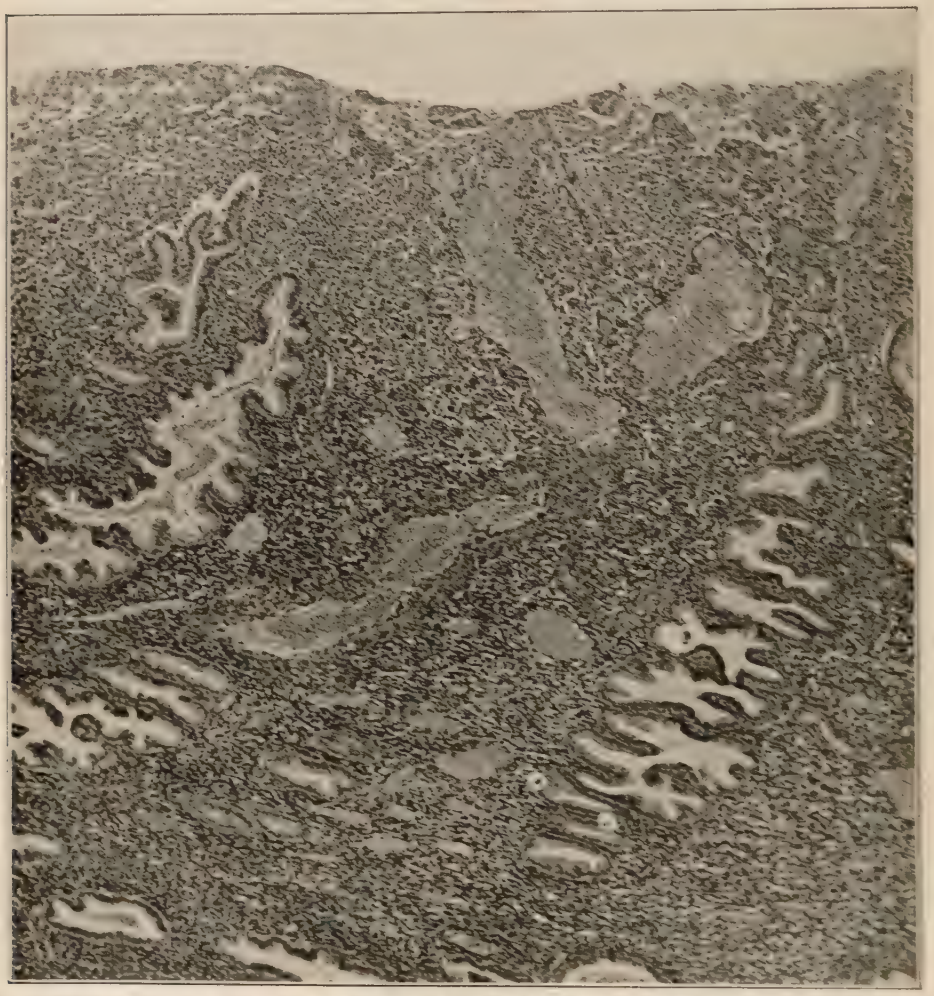

FIG. 2.—ENDOMETRIUM ON THE FIRST DAY OF MENSTRUATION, SHOWING THE COMPACTA, SPONGIOSA, AND PART OF THE BASALIS.

The greatly dilated blood-vessels, some of which are opening directly on the surface (rhexis), are especially prominent. There is a marked infiltration, especially of the compacta, the upper portion of which is being cast off in small particles. There are considerable individual differences in the degree of this endometrial loss on the first day.

menstruation, together with a number removed immediately before or just after menstruation. The study of this material, by methods which we believe eliminated errors of technic, convinced us that extensive loss of tissue is the rule during menstruation. The entire superficial or compact layer, as well as most of the deeper or spongy layer, is thrown off. It is possible that there

may be exceptions to this, but we have not observed them. On the first day the surface of the mucosa may be quite intact, but more commonly it shows beginning loss of tissue. By the second day the throwing off has become very extensive, all the compacta and most of the spongiosa being gone. Regen-

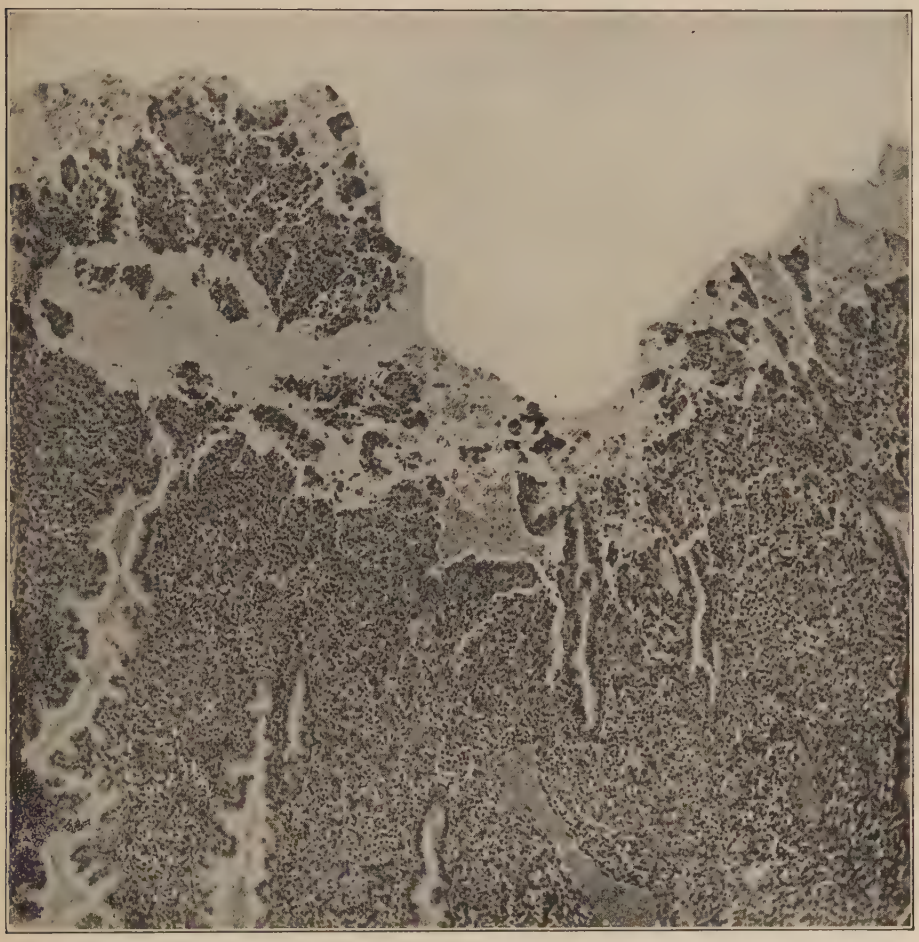

Fig. 3.—Section of Another Portion of the Surface of the Endometrium of the Uterus Shown in Fig. 2, Illustrating the Crumbling away of the Compacta and the Marked Cellular Infiltration (Slightly Higher Power).

eration changes are usually evident on the third day, and may be quite marked.

The desquamation of mucosa is preceded by extensive infiltration with polymorphonuclear leukocytes, this infiltration being marked for a short time before the actual clinical onset of menstruation. The throwing off of the mucosa does not commonly occur as an extensive shedding in large masses. It is a sort of crumbling, molecular process, small strips and bits of granular degenerated mucosa being cast off until only the basalis, and perhaps a few spongiosal rests, are left. The desquamated endometrial portions may be

recovered from the menstrual discharge, as we were able to show. Pyknotic changes are prominent at the beginning of menstruation.

Regeneration is remarkably rapid, especially the epithelization of the surface. The source of the new epithelium is chiefly the epithelium of the basal stumps of the uterine glands. Strange to say, mitoses are not very frequent,

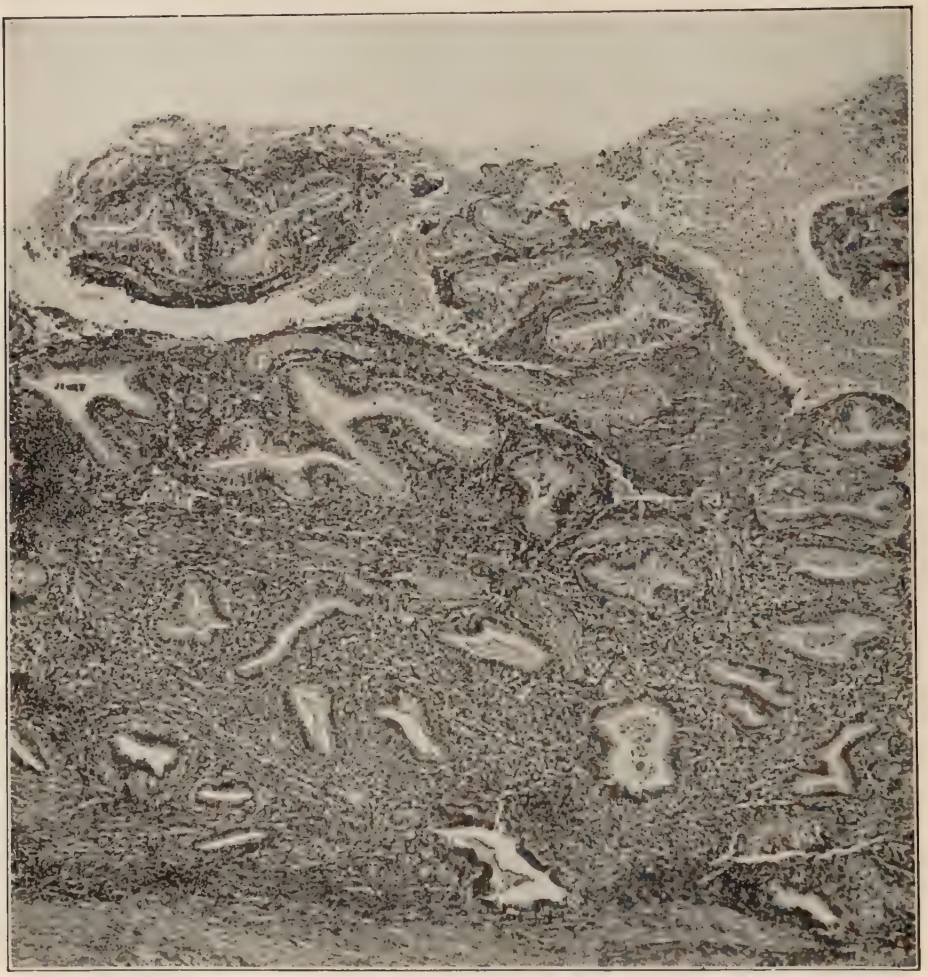

FIG. 4.—ENDOMETRIUM ON SECOND DAY OF MENSTRUATION, SHOWING THE BASALIS WITH ONLY A SMALL PART OF THE SPONGIOSA INTACT.

The compacta and the greater part of the spongiosa have been cast off.

appearing in by far the largest number when the epithelial layer is already complete.

While diapedesis may perhaps play some part in the mechanism of the menstrual bleeding, rhexis is certainly the most important factor. It can be demonstrated histologically, although its occurrence is self-evident, in view of the extensive tissue loss associated with menstruation.

Since the publication of our original paper, a large number of additional

observations have convinced us of the correctness of the observations just described.

The Ovarian Factor Concerned in Menstruation.—The problem which has excited more interest and discussion during the past few years than per-

FIG. 5.—BLOOD-CLOT OBTAINED FROM CAVITY OF THE MENSTRUATING UTERUS WHOSE ENDOMETRIUM IS SHOWN IN FIG. 4.

Cast-off particles of the upper two layers of the endometrium are seen, including not only surface epithelium, but also considerable stroma and numerous glands.

haps any other is that dealing with the relative importance of the ovarian follicle and the corpus luteum in the production of the reproductive cycle. Reference has already been made to the investigations of Allen, Doisy and their coworkers, who stress the follicle as the source of the female sex hormone, although this is to be found in other structures as well (certain stages of the corpus luteum, the placenta, etc.). Frank and his collaborators emphasize the unity of action of the follicle, the corpus luteum, and the placenta, and suggest the designation of "gestational gland" for this composite apparatus,

chiefly on the ground that extracts from these various organs are synergistic along certain lines.

On the basis of observations upon laboratory animals, moreover, the current trend appears to be to doubt that ovulation is a necessary precursor of

Fig. 6.—Endometrium on the Third Day of Menstruation, Showing Practically Only the Basalis Left Intact.

The epithelization of the surface has already begun, by the outgrowth of epithelium along the surface of the remaining glands.

menstruation. This skepticism has much to support it in the case of the lower animals, but very little in the case of the human being. Especially interesting, in this connection, has been the study made by Corner of the sexual cycle in monkeys, in which there occurs a menstrual cycle readily comparable with the human process. In his study of a series of monkeys (Macacus rhesus), in 1923, Corner found that in a considerable proportion no corpus luteum was

to be found in the ovaries when these were removed immediately after what was apparently a genuine menstrual flow, and he therefore very properly questioned whether the corpus luteum plays any part in the process.

Corner's paper, in which he suggested the possibility of menstruation without preceding ovulation, has been answered by Robert Meyer, who pointed out, among other things, that it was difficult to be sure that the bleeding observed in Corner's monkeys was in all cases analogous with normal menstruation. In the human female we likewise not infrequently encounter a form of pseudomenstrual bleeding in which corpora lutea are not only absent, but characteristically so. This form of abnormal menstruation is very common in women near the menopausal epoch, but may occur at any age during the reproductive years. It is not rare at or near the time of puberty. (See section on Hyperplasia of the Endometrium.)

As already mentioned, the characteristic findings in the ovaries of such cases are an absence of corpora lutea, and the presence of a persistent unruptured follicle, or, perhaps, of many maturing follicles. I believe that in such cases we are actually dealing with a follicular type of cycle, which persists in a vestigial way in certain individuals.

But this is certainly not the usual process observed in human females. Every gynecological pathologist will discredit this assumption. The examination of thousands of ovaries, in correlation with the endometrial changes and the menstrual histories, has convinced me of the regularity and normality of our findings in this respect. Just after menstruation we expect to find, and do find, the characteristic undeveloped endometrium (postmenstrual type) and, in the ovary, a retrogressing corpus luteum; in the interval phase we find a slowly developing hypertrophy of the endometrium, and, in the ovary, a corpus luteum showing more advanced retrogression. Moreover, it is in this stage that we find the earliest stage of the new corpus luteum resulting from the rupture of the mature graafian follicle. Again, in the few days just before the next menstrual period, we confidently expect to see the pregravid or secretory endometrium above described, and, in the ovary, a typical mature yellow body. Finally, the period of menstrual casting off of endometrium is accompanied by beginning retrogression of the corpus luteum. These observations have been made in so many laboratories by so many men that they must be accepted as authoritative evidence, just as we accept the quite different results obtained in the lower animals by the anatomists and physiologists.

For certainly this histological cycle does present important differences from that seen, for example, in the rat, in which the cycle is apparently fully run under the influence of the follicle alone, and in which it can be reproduced, in the spayed animal, by injection of follicle fluid alone. The relatively infrequent form of uterine bleeding above alluded to, in which corpora lutea are absent, constitutes the exception and not the rule. This type of menstruation is characterized especially by its excessiveness (functional menorrhagia), and this is presumably due to the absence of the corpus luteum, which normally exerts an inhibitory effect upon the further maturation of follicles.

It is possible that, in rare instances, even a normal menstrual flow in the

human may occur without ovulation; that is, that it may be due to the influence of the follicle alone. Until recently such a view would have seemed untenable to me, and even now I know of very little direct evidence to support it. But the splendid researches of Corner, Allen and Hartman upon monkeys, and the knowledge that in the human being a form of uterine bleeding, often definitely periodic, may be due to follicular influence in the absence of corpora lutea, makes it difficult to deny the possibility above alluded to.

Much light is thrown upon this problem by a study of the endometrium just before menstruation in monkeys. It may be mentioned that Allen's illustrations show no such condition as we find in the human at this phase. Corner also emphasized this fact, and speaks of two different kinds of premenstrual endometrium. One is essentially similar to the human and follows ovulation by about twelve or fourteen days. The other is devoid of the premenstrual features seen in the human, and apparently is not dependent upon a preceding ovulation. The latter is the more frequent type in monkeys, but the menstrual bleeding in the two groups of cases is apparently indistinguishable in type.

Knowing the accuracy of these observations of Corner and of Hartman, the conclusion seems inescapable that in the monkey either one of two types of cycle may occur. One is dependent upon ovulation, and in this the corpus luteum plays an important rôle, part of which at least is the production of a pregravid endometrium similar to that seen in the woman. In the second type, ovulation is apparently not essential, and in this the corpus luteum plays no known part, while the endometrium fails to show the markedly hypertrophic and secretory changes characteristic of the human premenstrual phase.

As already mentioned, there can be no doubt that in the human female the prevailing mechanism of menstruation is of the first of the two types above mentioned, *i.e.*, the corpus luteum type, as it may be spoken of for convenience. The evidence for this seems overwhelming. There are, it is true, a few scattered observations in the literature tending to show that menstruation may occur without ovulation and corpus luteum formation. Most of these, however, are unconvincing. And yet, as already stated, it would be strange if the follicular type of menstrual cycle did not occasionally persist in the human species. A recent observation of my own is suggestive, though not conclusive. A young woman of 19 whom I had treated for two years for functional menorrhagia was taken with acute appendicitis, so that an opportunity was given to inspect, at least hastily, the ovaries, as a right rectus incision was employed. I may add that, whereas her periods had formerly lasted for as much as two or three weeks and had been very profuse, the two or three periods immediately preceding the operation were much more moderate, lasting only four or five days. There had been no flow for two months until the day before the operation, when a slight menstrual show appeared. At operation the right ovary presented a large translucent follicle, evidently mature. No sign of a corpus luteum could be seen in this ovary or in the left. The day following the operation menstrual bleeding was resumed quite freely. This case suggests that the responsible factor was the large mature unruptured follicle, as, in my experience, a mature corpus luteum can usually be detected

even by simple inspection of the ovarian surface. Certainly none could be found in this case. This is the only instance which I have personally observed which would shake my belief in the invariability of the rule that menstruation cannot occur without a corpus luteum, *i.e.,* without a preceding ovulation. I believe, however, that more careful observation may conceivably show such cases to be less rare than I now believe them to be.

It would hardly seem necessary here to dispel a superficial misconception held by some of our profession to the effect that the corpus luteum is responsible for menstruation, applying the latter term to the actual bleeding of the process. This structure, of course, has nothing to do with the direct causation of the menstrual discharge itself. Indeed, menstrual bleeding occurs not because of, but in spite of, the corpus luteum influence. The latter, we believe, is responsible for the final and characteristic secretory developmental phase. If the corpus luteum influence persists undisturbed, as when pregnancy supervenes, the endometrial hypertrophy advances still further to genuine decidual formation. But if the corpus luteum influence is checked, as it is when fertilization fails and the ovum of the preceding ovulation reaches the end of its life span, then its protective influence over the growing endometrium is removed, and the endometrium dismantles itself, with bleeding as a chief accompaniment.

These statements are here set forth rather baldly, but they are supported by much evidence, except for the assumed influence of the ovum itself. We have no way of determining this point, and yet, a cell with such amazing potentialities as the ovum may well exert profound influences even before fertilization. How else can we explain the remarkable periodicity of the menstrual phenomenon than by ascribing it to some innate quality of the germ cell itself?

The above conception of menstruation and of the rôle of the corpus luteum is borne out by certain observations which can be made in the gynecological operating room. I have often noted that if, in a woman operated upon several days before the expected onset of menstruation, it becomes necessary to remove the ovary containing the corpus luteum, menstruation is precipitated, *i.e.,* it occurs soon after the operation, often within a matter of twelve to twenty-four hours, and rarely later than forty-eight hours. As far back as 1911, Neu made somewhat similar observations, although he did not correlate them with the corpus luteum, which was just becoming an object of intensive study. More accurate studies, tending to prove the same fact, have been made by Ostreil, Halban and Köhler, and others.

The explanation of such an anticipation of the normal menstrual date would seem to be in the removal of the corpus luteum influence, just as it normally is checked by the death of the ovum, if this be actually the dominating factor. It is, of course, conceivable that the premature onset of menstruation in such cases may be due to the nervous shock of the operation. This can be readily controlled by studying the effect upon menstruation of pelvic operations in which the corpus luteum is not disturbed. A small series of observations, which I have thus made, together with the general impressions gained over

many years before this, make me feel very strongly that it is the corpus luteum factor which is concerned with this disturbance of menstrual rhythm.

The general impression which one gains from a consideration of the facts which have been discussed is that a sort of evolutionary gradation of the reproductive cycle has been demonstrated in the results obtained with the various animals already studied, a gradation not unlike that exhibited by other body functions. In such animals as the opossum and rat, the evidence certainly indicates that the cycle is dominated by the follicle and that the corpus luteum does not become important until after impregnation. In the human, on the other hand, the follicle is of importance in the menstrual cycle, but so is the corpus luteum, which is well developed in the non-pregnant woman.

Finally, the observations thus far made on monkeys, chiefly by Corner and by Allen, suggest that in these animals an intermediate condition exists, so that in some the follicular type persists, while in others there has been an advance toward the human type. For that matter, it would seem that one and the same animal may, at different ages and under different environmental conditions, exhibit differing types of cycle. Even in the human being, if the views I have advanced be correct, there would at times appear to be a persistence of the more primitive follicular form of cycle.

After all, as Meyer says, unless our conception of the teleology of menstruation is all wrong, it would be surprising if the corpus luteum played no part in primary menstruation. If the premenstrual change in the endometrium is really a prepregnancy or predecidual modification, and if, as is commonly accepted, the corpus luteum plays a definite rôle in early pregnancy, it would require stronger evidence than now exists to convince one that the corpus luteum of menstruation is not also an important incretory organ. Historical evidence at least would suggest that just as the predecidual endometrium is by an easy transition converted into genuine decidua, so the corpus luteum of menstruation likewise passes directly over to the corpus luteum of pregnancy. It is hard, also, to deny that these two endometrial stages are not both due to the influence of the corresponding phases of the corpus luteum.

The corpus luteum is, in a sense, only a glorified follicle, and it is easy to believe that the function of the follicle is carried as a hang-over into the earlier stages of the corpus luteum. This is, indeed, borne out by the more recent investigations of Allen and others, who find the follicular principle in early but not in the late corpora lutea. But, just because the mature corpus luteum contains none of the follicular element, are we justified in assuming that it has no function whatever in human menstruation? Such a stand is untenable, even though, for the time being, injection experiments with corpus luteum derivatives have proved comparatively unfruitful.

An exception to this statement may be noted in the classical studies of Loeb and the recently published observations of Papanicalaou. The latter, for example, was able to bring about striking acceleration of ovulation in guinea-pigs by the removal of the corpus luteum, and corresponding retardation of the process by the injection of lipoid-containing corpus luteum extracts. He discounts the importance attached by some to the findings of the follicular

hormone in the corpus luteum, inasmuch as the latter apparently produces two hormones. The follicular substance, he believes, is "probably secreted by the undifferentiated theca or granulosa cells, while the specific luteal hormone is probably formed by the fully differentiated luteal cells, the latter increasing in number with the advancing differentiation and development of the corpus luteum."

This explanation, to my mind, is the proper answer to the claims made by Frank and his coworkers as to the unity of action of the follicle, the corpus luteum, and the placenta (the "gestational gland"), based chiefly on the fact that extracts from these organs are synergistic along certain lines. Such an assumption is unwarranted, not only because of the human evidence already set forth, but also because of the demonstration by Papanicalaou of a luteal hormone which possesses a function in many respects quite antagonistic to the follicle substance.

That these two hormones represent a sort of balancing mechanism is indicated furthermore by the recent investigations of Margaret Smith, who was able quite constantly to bring about an interruption of early pregnancy in rats by the injection of follicular extracts. It is during early pregnancy that the corpus luteum shows its most striking growth and is generally conceded to exert an important protecting influence upon the embedding of the fertilized ovum. As Smith says, "It seems quite improbable that the active part of the follicular fluid and the substance produced by the corpus luteum are identical, if the follicular extract injected at this time interferes with the normal development of the fertilized ovum."

As additional evidence against the view that the follicles and the corpus produce only one substance, and that the same, Smith mentions the difference in the effects produced by follicular injections upon ovariectomized and normal rats. In the former, injection soon results in the appearance of cornified epithelial cells in the vaginal smear, and if the injections be kept up daily for two weeks, these cornified cells persist throughout that time. In the normal rat, however, such an effect cannot be produced, for even though the injections be kept up the normal cycle asserts itself, as reflected in the vaginal smears. The only explanation of this fact would seem to be that the normal ovary contains some element which balances or antagonizes the follicle influence, and which, of course, is lacking in the spayed animal. It seems reasonably certain that it is the corpus luteum which plays this rôle. Smith mentions an observation which bears out this idea. In four apparently normal animals the follicle injections produced an effect similar to that characteristically found in castrated animals, as above mentioned. Two of these animals were autopsied and their ovaries found to contain large follicular cysts, but no corpora lutea.

May it not be that, in most women at least, the corpus luteum principle is efficacious only in an endometrium already prepared by the follicular substance, as it apparently is under natural conditions? I am speaking, of course, of the human female, because in such animals as the rat, as already stated, the cycle appears to be dominantly a follicular one, the corpus luteum being

perhaps more important after the inception of pregnancy. This idea will be alluded to again in the discussion of the therapeutic aspects of the problem.

A Menstrual Toxin (Menotoxin).—Chapter I is devoted to a consideration of superstitions based on the belief that the menstruating woman is a source of danger to herself and those about her. Ridiculous though many of these have seemed, a degree of confirmation is given them by the recent observations of Schick, corroborated later by Macht and Lubin. Schick observed that cut flowers handled by women who happened to be menstruating quickly withered. By extending these observations he concluded that the skin secretion of menstruating women contains some toxic substance which exerts this unfavorable effect upon flowers. For example, this effect could be avoided if the woman wore sterile gloves in handling the flowers. Macht and Lubin, studying the effect of various body fluids and secretions upon the growth of seedlings, concluded that a toxic substance (menotoxin) is found in the blood-serum, blood-corpuscles, saliva, sweat, milk, and other secretions of practically every menstruating woman, although there are marked individual variations in the degree of toxic action. The most marked effects are seen just before the beginning of the periods, and during the first few days of the flow. They suggest that the menstrual toxin is related chemically to oxycholesterin. Labhardt, Schubert and Steuding have reported observations discrediting those of Schick, so that further confirmation along these lines seems necessary. It should, moreover, be borne in mind that the observations of Schick, and the later ones of Macht and Lubin, indicate only that certain of the body fluids of menstruating women contain a substance or substances injurious to plant life, and that they cannot, of course, be interpreted as indicating that menstruation is a cleansing process. Their greatest practical bearing, it would seem, lies in the fact that they indicate a more or less systemic reaction to the menstrual phenomenon.

Metabolic Changes during Menstruation.—A recent study by Wakeham indicates that there is a fall in *basal metabolism* during or immediately after menstruation, and that there is a premenstrual rise. He further suggests, tentatively, that (1) basal metabolism is considerably higher, on the average, in those engaged in strenuous labor than in those of sedentary occupations; (2) that basal metabolism fluctuation in those living under uniform conditions is less than in those whose mode of life is more varied; (3) that the basal metabolism variation due to the menstrual cycle, while in every case less than the average daily fluctuations, is greater in active women than in sedentary women; (4) that causes which produce too frequent menstruation are likely to be accompanied by high basal metabolism; (5) that causes which delay or suppress menstruation are likely to be accompanied by low basal metabolism.

The *blood calcium,* according to a study of the ash of the blood from 20 women through two or three menstrual periods, varies between wide limits, but a tendency to rise with menstruation was noted, in 57 per cent. In 14 per cent the calcium content dropped.

Lang found that in healthy women menstruation has no effect on the basal metabolism, but that it does in women who are ill. Toward the end of the

interval and in the premenstrual phase the metabolic rate increases, while with the beginning of menstruation it drops quickly, reaching its minimum at the beginning of the interval. This cycle parallels in a general way that of the corpus luteum.

A study by King of the effect upon basal metabolism of various pelvic operations (bilateral oöphorectomy, unilateral oöphorectomy, hysterectomy) showed no permanent change as a result of such operations. Essentially similar results are reported by Geist and Goldberger.

A study of a large series of determinations of fasting blood-sugar levels in women at various phases of the menstrual cycle by Okey and Robb led them to conclude that the average values observed during menstruation are slightly higher than those for the intermenstrual period. However, they find a greater number, not only of high values, but also of low values, during menstruation than at any other time. They therefore advise that, in making single determinations of blood-sugar for diagnostic purposes the time of the menstrual period should, as far as possible, be avoided.

The *sugar metabolism* of menstruating women was studied by Heilig, who gave women 100 Gm. of saccharose on the first and second days of menstruation. The majority reacted with a marked hyperglycemia and a subsequent glycosuria.

Recent studies by Bond would indicate that there is a relation between the *ammonia coefficient* and menstruation. In the postmenstrual and intermenstrual periods the coefficient varies little from the intermenstrual average, but during the seven days previous to the period—*i.e.*, the premenstrual period—there is a marked rise. This rise appears to be due to a rise in the total output of urinary ammonia rather than to a decrease in the total output of urinary nitrogen.

Blood-Pressure during Menstruation.—Amos finds in a recent study of the subject that there is a decided fall of blood-pressure early in the menstrual period, and that this is often preceded, a day or so before the commencement of the period, by a rise, and further, that after the rather sudden fall, there is again a rise toward the end of menstruation, or a day or so after the period has finished.

Pulse during Menstruation.—Truesdell and Croxford, in a carefully controlled study of 6 women during nine menstrual cycles, found that the pulse rate is slower during menstruation and high in the intermenstrual periods. The systolic pressure rises previous to and during the early part of the menstrual period, while the diastolic rises during the period, with another rise midway between the periods. The pulse pressure, finally, rises above the average during the late intermenstrual period and throughout menstruation.

A number of authors have called attention to a *climacteric hypertension,* and I have personally observed a considerable number of this type. The hypertension is usually of moderate degree, and is much more amenable to treatment than other varieties. There is much reason to believe that the endocrine imbalance of the menopause has much to do with the causation of this syndrome, and ovarian therapy should therefore be a part of the treatment. Strassman found an average increase of 20 Mm. blood-pressure at the menopause, while

Marañon states that during the menopause more than one-half of all patients exhibit a greater or less rise of systolic and diastolic pressure. Sometimes this is associated with such symptoms as headache, dizziness, palpitation, or tinnitus. These results are similar to those reached by Lehfeldt, who found a pathological rise of blood-pressure, *i.e.*, more than 15 Mm., in one-fourth of all women passing through either the natural or artificial menopause.

Cause of Non-Coagulability of Menstrual Blood.—The cause of this interesting characteristic of menstrual blood still remains a point of discussion. Fellner, in a recent paper, states that the ovaries and the placenta contain, in addition to a coagulation-accelerating lipoid, another water-soluble substance which retards clotting, as he concludes from experiments which he describes. This retarding substance, moreover, he finds in the uterine mucosa, and also in the menstrual blood. He concludes from his investigations that the factor responsible for the non-coagulability of menstrual blood is a hormone secreted by the corpus luteum, this secretion being carried to the endometrium and there mixing with the menstrual blood.

Kraul's theory is quite different. His studies indicate that menstrual blood contains no fibrinogen, although the other essential coagulation factors are present. Moreover, the systemic blood during the menstrual period contains fibrinogen, suggesting that the alteration takes place in the endometrium. Furthermore, while the premenstrual endometrium, and also the systemic blood, exhibit a definite tryptic action, menstrual blood does not. His conclusion from such observations as the above is that the probable cause of the non-coagulability of menstrual blood is the destruction of the fibrinogen by a tryptic ferment in the uterine mucosa.

Climacteric Arthritis.—Various authors have called attention to a form of arthritis, occurring characteristically in women at or near the menopausal age, and presenting certain features which many believe distinguish it from the ordinary infectious type. This affection involves the knees by far most frequently, and often is confined to these joints. In other cases it is polyarticular, affecting not infrequently the small joints of the hands or feet. Associated with the knee involvement there is commonly noted a "panniculitis" of the inner side of the knee, the fusiform mass of thickened fat being quite firm and perhaps tender. In its earlier stages at least the lesion corresponds to the condition designated as villous arthritis.

To indicate that the affection is not rare, Cecil and Archer found that it constituted about one-third of a series of 116 cases of arthritis observed in the female. It runs a mild but chronic course. The chief point of discussion is as to its etiology, two chief views being held. One group of observers believes the arthritis to be of the usual infectious type, related to the menopause only in that at this age there is a greater predisposition to infectious and metabolic disturbances of one form or another. Others, again, believe that its etiology is in some way bound up with the endocrine system, although the exact mechanism is of course not clear.

The treatment embraces, first of all, the measures employed in the treatment of other arthritides, *viz.*, a search for a possible focus of infection, a low

caloric diet, physiotherapy, salicylates and iodids, etc. In addition, because of a possible relationship with the ovarian deficiency of the menopause, it would seem wise to employ ovarian therapy in conjunction with these other measures.

An excellent résumé of this subject is to be found in the symposium recorded in the *Proceedings of the Royal Society of Medicine,* of 1927 (Section of Balneology and Climatology).

Treatment of Amenorrhea by X-Ray.—Rubin and Rongy have recently published reports upon the treatment of amenorrhea by small "stimulating" doses of x-rays, following up the earlier work of Flatau and others. Their results were encouraging, although there is still considerable difference of opinion as to the relative susceptibility of the different constituents of the ovary to radiation.

Unsatisfactory Results from Benzyl Benzoate in Dysmenorrhea.—A recent report by the Council on Pharmacy and Chemistry of the American Medical Association calls attention to the generally disappointing results obtained from benzyl compounds, particularly the benzoate and the acetate, in the treatment of many conditions for which they had been highly vaunted. A recent paper by Gruber and Shackelford deals with the same subject. Certainly these views correspond with my own experience with the drug in the treatment of primary dysmenorrhea. The results, in my own hands, have been practically worthless, certainly not to be compared with those obtained from atropin, fallible though the latter is.

Hyperplasia of the Endometrium.—A recent study of 66 cases by Novak and Martzloff has served to emphasize the importance of this condition, already described on page 247 of my monograph. The lesion was first described by Cullen as far back as 1900. Clinically, its characteristic symptom is bleeding, while pathologically it is characterized by hyperplasia of both epithelial and stromal elements in varying degree and in varying proportion. The glands are of the "swiss cheese" pattern, large dilated glands being found side by side with glands which are small and narrow. The epithelium is at times considerably thickened, while the stroma is often overabundant and may give evidence of proliferative activity by the presence of an unusual number of mitoses.

Grossly the endometrium may be enormously increased in amount and may present the polypoid picture which has so often been incorrectly described as "chronic polypoid endometritis." In almost half of our cases, however, it was of normal thickness, and in over one-half it was smooth rather than polypoid. The hyperplasia may be localized in uterine polypi, in which case, unless associated with other lesions or with strangulation of the polyp, bleeding has not been a symptom. The hyperplasia pattern is not uncommon with adenomyoma, in either the endometrium of the surface or that of the islets in the musculature.

About one-half of our patients with hyperplasia were above 40 years of age, while the remainder were women under the age of 40. The occurrence of hyperplasia in girls near the age of puberty is, in our experience, not common (less than 5 per cent). Our study shows no definite abnormality in the menstrual history of these patients prior to the onset of the symptoms of hyperplasia. With the onset of the symptoms of hyperplasia there was, however,

in almost every case, excessive menstruation, manifested usually by an increase in both the amount and duration of the menstrual discharge.

Menorrhagia or metrorrhagia—the so-called "functional uterine bleeding"—may occur as symptoms of hyperplasia, the former being the more common

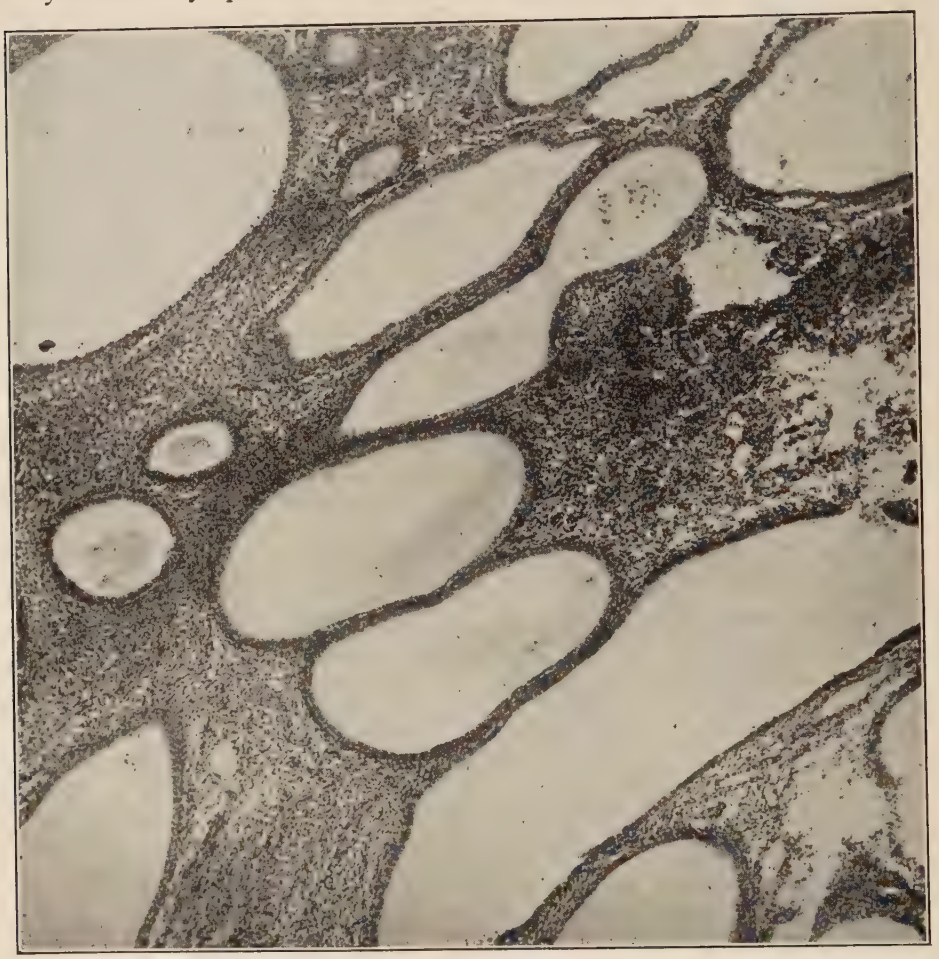

Fig. 7.—Typical Hyperplasia of Marked Degree from a Woman of 43, Who Had Had Uterine Bleeding for Several Months.

Note the typical "swiss cheese" pattern of the glands.

of the two. The passage of blood-clots is not unusual. Amenorrhea, as part of the symptom-complex of hyperplasia, was noted in about one-sixth of our cases. Pregnancy occurring after the onset of hyperplasia is uncommon in our study, but did occur in two patients. About one-half of our patients had had one or more full-term pregnancies prior to the onset of the symptoms which are associated with hyperplasia.

Schröder believes that an absence of corpora lutea in the ovaries is a characteristic finding with hyperplasia. We have found a few exceptions

to this rule, so that the matter needs further investigation. The characteristic gland pattern is attributed by some merely to epithelial hyperplasia, and by some to simple cystic distention, while to us the evidence suggests that an enormous overgrowth of the basal layer of the endometrium and an absence of the superficial functioning layers is sufficient to explain the characteristic picture.

In the section on the Ovarian Factor Concerned in Menstruation, of this supplement, I have suggested that this condition, with its characteristic symptoms of hemorrhage, may be a reversion to the follicular type of cycle characteristic of many of the lower animals, including some monkeys.

The therapeutic measures to be considered for the relief of the uterine bleeding associated with hyperplasia are curettage, organotherapy, radiotherapy, and hysterectomy. There are probably a certain number of mild cases which get well spontaneously. Curettage is necessary to make a diagnosis and may bring about relief of symptoms. Recurrence of the bleeding within a comparatively short time is more common, and repeated curettage may be necessary in the case of young patients where both radiotherapy and hysterectomy are undesirable. At the menopausal age the bleeding can be checked by sufficient dosage of either x-ray or radium. Hysterectomy is reserved for intractable cases where radium is unavailable or where associated lesions make laparotomy preferable to simple abolition of the menstrual function.

The most important clinical group of hyperplasia cases, and the largest one, is that occurring at or near the menopausal age. The importance of the condition at this age lies in the fact that it is brought into diagnostic conflict with cancer. While it is still true that climacteric bleeding should be looked upon as of cancerous causation until this assumption is disproved, the fact remains that in many cases the cause will be revealed as hyperplasia, a benign condition with no tendency toward malignancy. This is an important point to impress upon those interested in educating the laity in the early recognition of cancer, for there can be no doubt that not a few women with climacteric bleeding delay seeking medical advice through dread of being told that cancer is the cause of their symptoms. Any element of justifiable hopefulness that can be injected into the situation will be of material aid in the cancer education of the public.

The Cause of the Vaginal Bleeding of Tubal Pregnancy.—The studies of Sampson, in 1913, led him to the conclusion that the external bleeding of tubal pregnancy has its source in the endometrium. A similar view has been recently expressed by Polak and Wolfe, although these authors believe that in at least a certain number of cases, more particularly those of the interstitial type, the hemorrhage may proceed from the placental site itself. Novak and Darner, in a recent study, find that the bleeding in these cases is characteristically initiated by the death of the embryo, although other factors, probably of hormone nature, are undoubtedly concerned in its frequent continuance for many weeks. The source of these factors is probably in some unknown way associated with the persistence of trophoblastic elements in the

tubal wall long after the actual death of the embryo. In cases of tubal pregnancy in which the fetus is still alive, amenorrhea is the rule instead of bleeding. Cases of this type of course are far less numerous than those of the bleeding type, in which the fetus has succumbed.

Organotherapy in Functional Hemorrhages.—In the hemorrhages of puberty, Stickel and Zondek got successful results from the use of pituitary and testicular extracts, but met with failure from the use of corpus luteum and thyroid extracts. Twelve of 15 patients in this group were cured by the organotherapy, while 3 were failures. In hemorrhages occurring between the ages of 20 and 40, corpus luteum was more successful, although the best results were obtained from pineal, pituitary, and testicular extracts. In this group, organ extracts were of little or no value. The authors assume that many women at this age show a definite arteriosclerosis, and they suggest the injection of a mixture of pituitary and testicular extracts.

My own best results with organotherapy in the treatment of functional hemorrhages have come from the employment of a lipoid-containing corpus luteum extract, given hypodermically. In the usual cases of this type, the injections are given daily, beginning one week to ten days before the menstrual periods, and continuing throughout the latter. This treatment is along rational lines, as absence of corpora lutea is the characteristic finding in the ovaries of such cases (see Hyperplasia of the Endometrium). A daily injection of posterior pituitary extract, if the flow is excessive, is also of value.

Calcium Treatment of Menopausal Hemorrhages.—A study by Hornung was undertaken with the idea that perhaps climacteric functional hemorrhages were associated with a disturbance of the coagulation mechanism as a result of the disturbed function of the ovary. He states that in 80 per cent of the cases the intravenous injection of 10 c.c. of a 10 per cent solution of calcium chlorid brought about a cessation of the hemorrhages, though in some cases a second injection was necessary. He reports failure in only 8 per cent of the cases.

Autohemotherapy in Functional Hemorrhage.—This method is recommended by Bakscht, who reports success in a small series of cases. Fourteen c.c. of blood are drawn from the ulnar vein of the patient into a syringe containing 6 c.c. of sterile distilled water. The blood is hemolyzed by rapid shaking, and is injected intragluteally. Four or five injections may be given, at intervals of two days. Neither local nor general reactions occur, according to Bakscht.

Vicarious Menstruation.—A rather extensive study of this somewhat confused subject was made by Roth, who found 225 cases recorded since 1870. In 30 per cent the vicarious bleeding took place from the nose; in 10 per cent from the skin or from fistulæ; in 8 per cent from the lungs; in 4 or 5 per cent each from the breast, stomach, mouth, and throat; in 3.5 to 4.5 per cent from the bladder, ear, eye, intestine, larynx, trachea, kidneys, and vagina. In 25 per cent the bleeding was purely vicarious, in 75 per cent it was supplementary to the normal flow. Three fatal cases occurred, the vicarious hemorrhages coming from the lungs or bronchi. Roth em-

phasizes the fact that only cases of the more severe types are published, so that the phenomenon is probably more common than might be surmised from the literature. He mentions two personally observed cases. In one the patient began to bleed from the bowel at regular intervals nine months after the onset of the menopause. In the other, the blood was vomited, without retching, at each menstrual period. At all other times the stomach was free from blood.

Transplantation of the Ovaries.—A number of reports dealing with this subject have appeared within the past few years. Tuffier has described a method of autotransplantation of the ovary, with its pedicle, within the uterus. The operation is said by him to be followed not only by the preservation of menstruation, but also by the possibility of impregnation. The study of 98 cases by Bell leads him to advocate ovarian grafting very strongly in suitable cases, although it cannot be compared with preservation of the natural connections of the ovary. Sippel's report, based on 57 cases, includes a discussion of the employment of transplantation of the ovaries in such conditions as infantilism, premature and artificial menopause, and premature senility. Finally, attention may be called to the recent review of this subject by Martin, the sixth which this author has published. His conclusions are as follows: (1) Clinically there is very little to encourage one to believe that transplantation of the ovaries as practiced up to the present time has more than speculative value as a surgical procedure. (2) There is some evidence that autotransplants are of some value in deferring the symptoms of the menopause and delaying the cessation of menstruation. It is difficult, however, not to attribute some of this evidence to suggestive therapeutics or to unattached ovarian tissue left *in situ*. (3) There is practically no convincing evidence that homotransplants have been successful in the human female. (4) There is no evidence that heterotransplants have been successful where the human female has been the recipient. (5) There is some encouraging evidence recorded in experimental animal surgery that not only autotransplants, but homotransplants and even heterotransplants have been successful and the sexual function of the castrated animal maintained. (6) The technic followed by the various operators on human females, in too many instances, seems unsurgical and too often is incompletely and loosely recorded, leaving the impression that the conclusions derived from such work must be unreliable. (7) There is, however, encouraging evidence in all of this endeavor to lead one to hope that the subject will be pursued experimentally, especially for the purpose of devising a rational and simple technic, based on the work of the serologists, the endocrinologists, the hematologists, and the practical clinical surgeons.

Growth of Human Ovarian Tissue in Vitro.—Zondek and Wolff report the results of experiments upon the cultivation of human ovarian tissue outside the body. Cultures of fetal ovary, eight months, removed eight hours after death, showed a growth of the germinal epithelium. Granular cells were found in cultures of ovarian tissue removed from a woman who had cancer of the uterus.

Vaginal Changes during Menstrual Cycle.—In view of the well-known cyclical changes in the vaginal mucosa of the lower animals, it is of interest to note that somewhat similar changes have been found to occur in the human vagina. The most recent and most complete study of this question is that of Dierks. A few days after the beginning of the menstrual period three definite layers could be distinguished in the vaginal epithelium, this becoming more marked in the premenstrual period. A "functional" and a "basal" layer are separated by a well-marked intra-epithelial horny layer. At menstruation the functional layer and a part of the basal are desquamated.

Cyclical Changes in the Breast.—Dieckmann, Rosenburg and other authors have reported studies indicating that the mammary gland undergoes, during the various phases of the menstrual cycle, a series of changes not unlike those observed in the uterus. There are some differences of opinion as to the exact nature of these changes, but in the main they are characterized by a marked development of the lobular acinous tissue during the premenstrual epoch. Just after menstruation the gland tissue is practically absent.

Postmenopausal Bleeding with Ovarian Cancer.—Schiffman, Neumann, Meyer and others have called attention to the occasional association of postmenopausal bleeding with ovarian cancer. The form of cancer which is usually responsible for this syndrome is the so-called granulosa-cell type, which is being recognized with increasing frequency. This form of cancer has the capacity of reawakening the endometrium to renewed development, with the production of a definite hyperplasia, accompanied by the bleeding so characteristic of the latter.

The practical importance of this point is obvious. If uterine bleeding occurs in women beyond the menopause, the first suspicion is of course of uterine cancer. If diagnostic curettage shows no evidence of cancer, one should always bear in mind the possibility of ovarian cancer, even though this is not suggested by the findings on bimanual palpation.

Does True Menstruation Occur in Pregnancy?—While it is commonly accepted that menstruation may occur one or many times after the inception of pregnancy, the genuineness of such cases would be more convincing if it could be shown that endometrium has actually been thrown off, and that a corpus luteum of menstruation was actually formed, in addition to the corpus luteum of pregnancy. These points are emphasized by Wintz in an interesting study of the problem, published recently. He reports a small series of cases in which these criteria have been met, and which apparently demonstrate the possibility of the occurrence. He believes that in these cases the impregnated ovum, during menstruation, escapes casting off, as it may still be in a protected position in the tube, although I do not see how this explanation could apply in those cases where menstruation recurs a number of times. Another possibility which Wintz suggests is that spermatozoa entering the uterus several days before menstruation do not meet the ovum before its death, and that they then remain until the next ovulation. This explanation likewise would scarcely be generally acceptable. Many cases of what is apparently genuine menstruation have been observed during pregnancy. My

own impression is that ovulation, ordinarily inhibited during pregnancy, in some cases persists for one or more months, and that menstruation may have its source from the decidua vera, just as from the non-pregnant endometrium, without disturbing the firmly implanted ovum.

Menstruation and Tuberculosis.—Maendl states that auscultation during menstruation reveals dry râles in the apices of tuberculous women, in whom at other times such signs are lacking. He regards this phenomenon as of help in diagnosis. A recent observation of Bricker also seems worth mentioning. He found that normal rabbits, inoculated with tubercle bacilli, began to lose weight at once, while castrated rabbits did not change for a long time. He believes that the removal of the ovaries produces changes which increase the body resistance against the tubercle bacilli.

Menstruation and Mental Disease.—Swanberg and Haynes report the study of 700 feeble-minded women from this standpoint. In 425 menstruation was normal, in 177 there was a physiologic amenorrhea, and in 108 some form of pathologic menstrual disturbance was noted. The most common disorders were irregularity, amenorrhea, and dysmenorrhea. The percentage of menstrual disorders was in proportion to the degree of mental deficiency; the lower the mental state, the greater the number of pathologic cases. Amenorrhea and possibly oligomenorrhea were far more frequent among the lower types, imbeciles and idiots, while the vast majority of cases of dysmenorrhea were among the higher class, the morons.

Répond has recently reported a study of the effect of menstruation upon the mental symptoms of 102 insane women, of whom 85 suffered with dementia præcox. Contrary to the usual view, he found that menstruation appeared to have no effect in exaggerating these symptoms.

Menstruation and Hodgkin's Disease.—Of 57 cases collected from the literature by Gemmell, all occurring in females, 39 were in women during menstrual life. In only 17 was the menstrual history available. In 3 menstruation was normal, in the other 14 there were varying degrees of oligomenorrhea, as far as complete amenorrhea in some cases. He suggests the use of ovarian extract in these cases, in addition to the usual treatment of the disease.

Menstrual Peritonitis.—A case of supposed "menstrual peritonitis" is reported by Adami. The patient was a girl of 14, who died on the third or fourth day of menstruation. Twelve hours after the completion of an athletic contest, the girl was seized with acute abdominal discomfort, then intense pain, followed by coma and death twelve hours after the onset. The autopsy showed the usual changes of menstruation, with a definite accumulation of translucent fluid in the pelvis. The examination of the abdominal fluid showed a pure culture of streptococcus in long chains. Adami suggests that during menstruation the mouth of the uterus is open, and that a negative pressure, such as might occur with various forms of exercise, might cause a sucking into the peritoneal cavity of some of the vaginal contents. Needless to say, such an explanation is purely speculative, and, furthermore, it lacks the ring of plausibility.

Ovarian Therapy.—*Present Status.*—The author's present views on this subject were epitomized in a recent brief paper published under the auspices of the Council on Pharmacy and Chemistry of the American Medical Association, and it may therefore be justifiable to quote this paper in full:

The known facts as to the function of the ovary are sufficient to supply a rational basis for ovarian therapy. Especially important in this connection is the study of the phenomena produced by complete removal of ovarian tissue—the cessation of menstruation, the frequent appearance of troublesome subjective symptoms similar to those of the natural menopause, the occurrence of certain metabolic changes, etc. The obvious suggestion derived from such observations is that clinical symptoms thought to be due to ovarian deficiency might be cured or relieved by administering some form of ovarian substance. This fundamental idea has been subjected to some refinement as a result of studies aiming to stress some one or other of the ovarian constitutents as the source of the active principle. Based on such investigations, several forms of ovarian therapy have developed—the administration of whole ovary substance, of corpus luteum extract alone, of the so-called ovarian residue, etc.

The first serious attempts at ovarian therapy were made in 1896 at the Landau clinic in Berlin, the preparation used being the fresh ovarian substance obtained from the cow or sow. Fraenkel, the foster father of the corpus luteum theory of menstruation, is also responsible for the use of the corpus luteum extract, which he employed in a small series of cases. The paper of Burnam in 1904 did much to popularize this form of therapy. A third preparation was suggested by Graves in 1919. It is obtained from that portion of the ovary remaining after removal of the corpus luteum. The study of the pharmacodynamics of the various forms of ovarian extract has until recent years yielded unimpressive results as regards the generative system. The most important fact gleaned has been that, in general, watery extracts are comparatively inert, and that the activity of the ovarian principle is in some way bound up with the lipoid content of the ovary. This point has a practical bearing in that it is a strong argument against the degreasing which is so often a step in the process of preparation of the commercial extracts.

The commercial extracts available are extracts of the whole ovary, corpus luteum extracts, and the ovarian residue. All these are procurable in the form of tablets, capsules, powder, or watery solutions (in ampules). The last named are probably inert, if the observations above quoted are correct. And yet they have achieved an enormous vogue. Of the other forms, it is difficult to outline indications for preference of whole ovary over corpus luteum, or vice versa. If any rule is possible, it would perhaps be that whole ovary is the more rational in developmental disorders of ovarian origin, whole corpus luteum extract is perhaps more desirable in those disturbances revolving about the menstrual function. The theory for the employment of ovarian residue is not convincing, and its use is not by any means as general as that of the other two. *The evidence for the value*

of oral ovarian therapy is unconvincing, and there is a growing skepticism in this regard. The watery extracts so widely used for hypodermic administration are probably inert, according to the best evidence available. Any good results obtained from their use are probably due either to the psychic factor or to the presence of protein factors which stimulate glandular structures generally, in accordance with the modern theory of protein therapy.

Indications.—Functional Amenorrhea, Especially in Association with Adiposogenital Dystrophy.—Here the indications are theoretically good, but the results are not very striking, even when combined with thyroid or pituitary extracts, as is usually done. And yet ovarian therapy is here, more rational and much safer than the various so-called emmenagogue drugs, such as manganese or the vegetable oils. Ovarian therapy should not be used until the physician is satisfied that the amenorrhea is not, as is so often the case, a mere symptom of incipient tuberculosis, anemia, or other systemic disease.

Menopausal Vasomotor Symptoms.—Authors are almost unanimous in ascribing some virtue to ovarian therapy for this indication. Corpus luteum extracts are used perhaps more generally than those of the whole ovary. They appear to give some relief from the hot flushes, the heat flushes, the vertigo, and headache of the menopause. Often, on the other hand, they fail to help. There is some risk in drawing conclusions where one is dealing with such purely subjective symptoms, but the evidence of therapeutic value is greater with this than with any of the other indications for ovarian therapy.

Uterine Hemorrhage.—While a few writers report good results from ovarian therapy in certain forms of hemorrhage (especially the so-called functional hemorrhage of the menopause), this form of medication cannot be looked upon as offering very much hope of success—certainly no more than that offered by treatment with thyroid or posterior pituitary extracts. It should not be employed until after the diagnostic elimination of organic pelvic disease, especially cancer.

Dysmenorrhea and Genital Hypoplasia (Infantilism, etc.).—The only type of dysmenorrhea in which, even theoretically, organotherapy would seem to be indicated, is the so-called primary dysmenorrhea. This is commonly associated with varying degrees of underdevelopment of the uterus. This uterine hypoplasia is almost surely due to an endocrine defect of some form, although its exact nature is not known. Deficiency of the ovarian secretion is believed by many to be a factor, either primary or secondary, in this syndrome, and hence it is often used for its correction. Here again there is an obvious element of empiricism and hence it is not surprising that the results are anything but impressive.

Sterility.—What has been said of dysmenorrhea may be said of sterility. When combined with developmental deficiency of the uterus, organotherapy is a rational method of treatment. A few reports of good results are to be found in the literature (Fallenberg, Solomons), but far more frequently the results are disappointing. The essential importance of excluding the more common causes of sterility (inflammatory or other obstructions in one

part or another of the genital tract, the male factor, etc.) need scarcely be emphasized.

Obesity of Hypogenital Origin.—This symptom is most often noted at the menopause, either natural or surgical. Certainly the administration of ovarian extracts for this indication is based on good grounds, and yet the results are not very striking, unless these extracts are combined with thyroid, in which case the latter is undoubtedly the potent agent.

Vomiting of Pregnancy.—This indication would not be entitled to the dignity of separate mention except that the hypodermic employment of corpus luteum extract for this symptom has achieved considerable vogue because of the recent publications of Hirst. The reasons given by this author for the form of treatment are speculative and illogical. When the method has been properly controlled, as in the study of King at the New Orleans Clinic, the results claimed by Hirst have not been confirmed. Moreover it is probable, as already stated, that the watery solutions used for hypodermic medication are inert. This method of treatment is a good illustration of organotherapy of the less desirable sort.

Other Indications.—One need only mention a list of indications for which ovarian therapy has been employed by various enthusiasts, usually without reason and almost always without result, *viz.,* repeated abortions, uterine fibroids, Graves's disease, deficient mammary secretion, epilepsy, pruritus vulvæ, etc. It may safely be said that no patient suffering from any of the above disorders will suffer from the omission of ovarian organotherapy.

In conclusion, it may again be emphasized that, rational as ovarian therapy appears to be in some conditions, the results are rarely striking and often nil to the level-headed observer. It cannot be assumed that a commercial extract can replace the normal secretion in the patient's body, or, for that matter, that it originally contains any of the active hormones of the ovary. Here lies the crux of the whole problem, whose solution will depend in large measure upon the work of the biochemist. Until this day, the physician who uses ovarian therapy should keep his feet on the ground, and not let himself be carried away by the exaggerated claims of those who have something to sell, or the ill-advised and premature reports of honest but deluded professional colleagues who have not yet learned the dangers lurking in the "post hoc propter hoc" method of reasoning. As I once heard a wise man say, "Ought we to assume, if the administration of cascara relieves constipation, that the constipated individual had been a victim of hypocascarism?" There can be little question as to the future importance of ovarian therapy; as regards its present importance, there is considerable room for discussion. Certainly there is much doubt as to the value of the oral administration of ovarian extracts.

New Methods of Ovarian Therapy.—Reference has already been made in the section on The Ovarian Factor Concerned in Menstruation, to the recent investigations by Allen, Frank, and others, in which the follicular hormone is stressed as the one of dominating importance. As might have been expected, one of the earliest results of this newer work on the physiology of

the ovary has been an effort to apply it clinically. No criticism can be made of such an ambition, provided that the therapeutic research is based upon sound scientific principles. In spite of the incompleteness of our knowledge of the subject, it is only fair to state that the recent work discussed in this paper offers, perhaps for the first time, something very tangible for clinical experimentation upon the human, and such observations will yield just as valuable evidence along certain lines as will the study of laboratory animals.

It is not my purpose to report statistics as to my results in the comparatively small groups of cases which I have thus far had occasion to treat in the light of this newer work, but rather to comment upon certain new viewpoints which these investigations have appeared to inject into the practice of gynecological organotherapy. My views on the general subject of ovarian therapy, and they were rather pessimistic, are expressed in the preceding section.

The chief indications for the use of follicular hormone would appear to be those associated with hypofunction of the ovary. The most important of these are amenorrhea and the subjective symptoms of the menopause. To these may perhaps be added certain types of obesity and certain cases of sterility. Neither of these two latter conditions, however, is associated in a very clear-cut way with ovarian deficiency, while the first two named are, and it is to these two alone, *i.e.*, amenorrhea and menopausal neurosis, that I have thought it best to limit this discussion.

The preparation of follicular hormone which I have used is prepared by a technic similar to that recommended by Allen and Doisy, and is standardized on the rat-unit basis. At first the ampules contained only a few rat units, but more recently the strength has been greatly increased, to even 100 units per ampule, although some deterioration of these stronger preparations is said to occur. No rules can be laid down as to dosage. From a practical standpoint, a daily injection is as much as we can expect the ordinary patient to take, so that, with the earlier weak preparations, the total dosage would seem to have been woefully inadequate.

Amenorrhea of the so-called functional type would appear to constitute the most trustworthy test for the efficacy or inefficacy of the treatment, for here the hoped-for results are distinctly objective. At the outset I may say that I have not been able to produce menstruation by the injection of follicular hormone in any of the cases which I have thus treated. In most of these, I should say, the extract used was quite weak (varying from 10 to 25 units per ampule). More recently, however, a much stronger preparation was available, but the results have been the same. Nor have I been able to convince myself of any such noticeable increase in the size of the uterus as Allen and Pratt have reported in a few cases.

These failures were not surprising to me, inasmuch as I have always felt that the follicle hormone, important as it may be, can scarcely be expected to carry the histological cycle of the endometrium to the point where the ensuing involution would be apt to produce a menstrual hemorrhage. It is conceivable, of course, that very strong dosage over many days might actually cause a hemorrhage of the type described earlier in this chapter as of probably follicular

causation, *i.e.*, the so-called functional uterine bleeding. But I have personally not observed such a result, although a small number of successful results have been reported by others.

More recently I have been attempting to imitate what I believe are the steps occurring in the normal menstrual cycle. As already indicated, it is probable that in the human being the follicle produces the first phase of the cycle, and that the corpus luteum then takes up the process, carrying it up to the time of actual menstrual bleeding. It seems plausible to assume that neither follicle extract nor corpus luteum extract alone can fill the bill, that the follicle produces an effect which is usually insufficient for menstruation, and that the corpus luteum extract exerts its effect only in an endometrium already partially transformed by the follicle influence. A logical plan, therefore, would seem to be to give follicle extracts for a good many days, and then to inject corpus luteum extract, if a good one can be found. At my suggestion, the biological department of Parke, Davis and Co. were good enough to prepare a lipoid-bearing corpus luteum extract, this being done by two methods.

These extracts were prepared essentially by the same methods that are known to yield the active lipoids from other parts of the ovary, as, for example, from the follicular fluid.

(a) Extract Hog Corpora Lutea.—Ground corpora lutea were allowed to stand over night in 7 volumes of 75 per cent alcohol. This was filtered, and the residue extracted with hot alcohol (95 per cent). The extracts were combined and distilled *in vacuo*. The residue was extracted with ether, and after removal of the ether the extract was emulsified in water, in the ration of 1 c.c. emulsion to 4 Gm. ground corpora lutea. No physiological standardization was made.

(b) Corpus Luteum Lipoidal Extract.—The method of preparation was the same as the above, except that the ether extract was purified with acetone, and the final emulsion was in a 0.05 per cent solution of sodium bicarbonate. One c.c. of emulsion represented 4 Gm. corpora lutea. The estrum-producing power of this extract was approximately 1 rat unit per c.c., thus showing that some of the follicular hormone was present. The extract was not tested for corpus luteum activity, since no definite method is as yet available for testing this type of activity. For this reason the extract was put up on the basis of 4 Gm. of fresh gland to each c.c. of final emulsion.

Only a small number of cases have been treated by this method, but it is in this small group that I have observed the most encouraging results. In two of these, menstruation has apparently resulted from a series of injections of follicular extract, followed by a series of injections of the corpus luteum extract. In one case the amenorrhea had been of only four months duration, so that the importance of the injection in the subsequent menstruation appears less striking than it might otherwise be. This patient was 26 years of age, and her amenorrhea was of the so-called hypopituitary type. It was associated with a moderate degree of recently acquired obesity. A menstrual flow lasting three days followed the daily injection for twelve days of the follicle substance, followed by six daily injections of the corpus luteum

extract. It is interesting to note that the flow appeared only after the injection of two more follicle substance injections, in a second series following the corpus luteum injections. This case is a recent one, and I merely mention it without any particular stress, as I have not been able to prevail upon the patient to submit to further observations along this line.

The other case, to my mind, is somewhat more impressive. The patient, a trained nurse of 36, had always beeen irregular in her menstrual history, with periods of amenorrhea lasting as long as six months. Three years ago, however, the periods ceased entirely, and there had been occasional vasomotor flushes, suggesting a premature menopause. There had been no increase in weight. Daily injections of follicle substance alone were given without result, so that treatment was discontinued.

After several months, I prevailed upon the patient to try the experiment of continuing the follicle and corpus luteum substances in the manner above outlined. The treatment presented less practical difficulty than usual, as the injections were given by the resident physician of the hospital with which the patient was associated. Again a dozen follicle substance injections were given, followed by six of corpus luteum extract. No result being obtained, a second series of follicle injections was advised, and here, almost as in the first case, menstruation appeared after one of these had been taken. The patient was encouraged by the fact that menstruation had thus appeared after a lapse of three years, and was quite willing to keep up the experiments. One week after the flow, which was free and of four days duration, the injections were again begun, and menstruation again ensued. This was repeated for four months, when the injections were discontinued. Amenorrhea for two months then occurred, following which the injections were resumed, with the production of menstruation once more.

Skeptical though I have been about the value of organotherapy in menstrual disorder, this case appeared to leave little doubt as to the part which it played in this instance. I do not know why an exactly similar plan failed in other cases in which it was tried.

The encouraging result in the two cases above described is mentioned only casually, with no desire to vaunt this plan as a cure for amenorrhea. My own interest in it lies chiefly in the fact that such a method is in accord with what many of us believe it is the true explanation of the mechanism of human menstruation, as I have already indicated. At any rate, it would seem worth while to try this method on a wider scale, rather than to draw our conclusions as to the value or lack of value of ovarian organotherapy from the administration of follicle substance alone or corpus luteum extracts alone.

So far as I have been able to judge, such effects as have appeared to follow the employment of the follicular hormone have been of a purely substitutional nature. In other words, no evidence has as yet been obtained to suggest that the substance actually awakens the slumbering ovarian mechanism to renewed activity. For example, in the case above noted, in which the administration of the follicular and corpus luteum substance was followed by the appearance of menstruation, the function failed to persist after withdrawal of the extracts.

The same statement may be made with regard to the treatment, by this method, of the menopausal vasomotor symptoms, in so far as the subjective element will permit of conclusions. Whether or not this view is correct must be determined by the study of a far larger number of cases than have as yet been subjected to this form of treatment.

Amenorrhea of the endocrinopathic type is in itself a harmless condition, and is compatible with perfect health and well-being otherwise, so that the question which naturally arises with regard to the treatment of many of these cases is "cui bono?" It is hard to persuade women to submit to a long series of daily injections for the treatment of a symptom which, we must admit in all honesty, carries with it no known element of risk. There are two considerations which induce some women to submit to the treatment willingly, or even eagerly. The first of these is the psychic factor, the feeling on the part of some women that absence of the menstrual function defeminizes them and sets them apart from others of their sex. The other is the fact that amenorrhea of this type is most frequently, though not invariably, associated with sterility, so that the real motive for treatment in such cases is the desire for motherhood.

This is, of course, reason enough to justify effort along the lines of rational organotherapy, and it is this incentive for treatment which I have most often encountered in the treatment of functional amenorrhea. I shall not here enter into a discussion of the endocrine factors, other than the ovarian, which may be concerned in the production of this type of amenorrhea, such as the pituitary, the thyroid, etc. In all of them the amenorrhea is presumably due to a deficiency of the ovarian secretion as the immediate cause, whether this be primary or secondary, so that the ovarian therapy is certainly a rational portion of the treatment.

Where the desire for pregnancy does not exist, the motive for a long-continued treatment, especially where this means frequent visits to a doctor's office for the injections, is lacking, and the enthusiasm of such patients is apt to wane long before that of the physician. This is a serious practical disadvantage of the treatment, although it should not deter us in our efforts to carry on these experimental studies on the human female on as large a scale as possible.

As to the effect of the follicle preparation upon the subjective symptoms of the menopause, either natural or artificial, I have been unable to convince myself as yet of any great superiority over the results of the older methods of organotherapy. While the number of cases of this sort which one encounters is naturally larger than those of the functional amenorrhea type, conclusions are hard to reach because of the difficulty of eliminating the psychic factor, and because of the well-known fluctuations in the severity of the vasomotor symptoms exhibited from day to day by the same patient, as I have elsewhere discussed. The uncertainty of this form of therapy would, in fact, suggest that the characteristic vasomotor symptoms may be due to some factor, perhaps of sympathetic nerve mechanism, not attributable to the mere deficiency of the ovarian hormone or hormones.

Radium Therapy of Benign Uterine Bleeding.—The treatment of bleeding associated with uterine cancer is of course subordinated to the treatment of the cancer itself, and this is a subject which we need scarcely consider in this chapter. It is with the benign hemorrhages that we are more directly concerned, especially those due to uterine myomata and those of so-called functional nature. In the latter, as we have already seen, the mucosa in a very large proportion of cases shows the condition designated as hyperplasia of the endometrium. Clark and Keene, from their study of 527 cases of these two groups, have drawn conclusions which may be taken as reflecting the opinions of those best qualified to speak on this subject. Radium and surgery must supplement each other in the treatment of cases of this type.

In the treatment of the hemorrhages of adolescent girls and young women, which resist less active measures, they advise caution in the use of radium. Only a very small initial dosage is employed. They suggest 50 Gm. for from three to four hours. The treatment is not to be repeated in less than six months, at which time it may be extended to from four to six hours. They have had no failures following the second application, although cases of this group have been very infrequent.

The functional bleeding of the menopause furnishes perhaps the clearest and most satisfactory indication for radiotherapy. The importance of excluding malignancy, usually by diagnostic curettage, is obvious. As Clark and Keene state, radiotherapy in these cases "is effective, it is quick in giving relief, the treatment does not incapacitate the patient, it is safe, and it is followed by practically no immediate disabling sequelæ or remote ill effects."

With regard to the treatment of hemorrhage during active reproductive life, great care is necessary in the employment of radiation, chiefly because of the risk of sterilizing the patient. There are many radiologists who believe that this risk can be almost entirely obviated by using small dosage, but it is probable that most gynecologists will continue to use this form of therapy for this group of cases only where all other measures fail. Certainly the patient is entitled to the confidence of the surgeon when radiotherapy is contemplated, and her own preference, after a fair presentation of the case, will often be a satisfying guide to the surgeon in his management of the case.

With regard to the bleeding so often seen with uterine myomata, opinion has crystallized fairly well. Where hemorrhage is the chief symptom of such tumors, and where they do not exceed the size of a three (some say four) months pregnancy, radiotherapy is indicated. When they are larger than the size above indicated, when they are complicated by pelvic inflammatory disease, and when they are causing serious pressure symptoms, radiotherapy is contra-indicated. Calcified and large submucous tumors are also considered by Clark and Keene as unsuitable for irradiation. Finally, it need scarcely be said that the treatment of myomata occurring in young women is subject to the same restrictions, based on the danger of sterilization, which have been mentioned above in connection with the subject of functional hemorrhage.

Graves calls attention to certain unpleasant symptoms which may be noted after the use of radium in cases of uterine hemorrhage. He mentions especially nausea, continuance or reappearance of the bleeding, leukorrhea, pain, acute nephritis, and nervous symptoms.

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SYMPTOMS IN GYNECOLOGY

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THE IMPORTANCE OF A UNIFORM PRESSURE RATE FLOW IN TRANSUTERINE INSUFFLATION TO DETERMINE PATENCY OF THE FALLOPIAN TUBES

The method of transuterine insufflation first devised in 1919 has been widely adopted and is employed not only by the specialist in gynecology but also by the general practitioner. The test of tubal patency has developed out of many attempts to find a method simple enough to be employed as a routine diagnostic procedure similar, let us say, to cystoscopy. I have done transuterine insufflation many hundreds of times in my office either alone or with the assistance of one nurse. Yet notwithstanding this uncomplicated technic there have been a not inconsiderable number of modifications of the method whose purpose was still further to simplify the original method. It has been held that the apparatus required is too cumbersome, necessitating the assistance of one or two persons. For the convenience of others I adopted the automatically acting siphon volumeter to which has been added a manometer (Fig. 1). The apparatus is not cumbersome. The outlay made at the beginning is permanent and except for refilling the gas tank needs a negligible amount of handling.

The fact that carbon dioxid has proved to be the most readily resorbed of all the available gases has made it preferable for use in the office. The commercial supply of this gas is usually delivered in large quantities and under great pressure, requiring therefore a reduction valve to regulate its flow.

There are two ways by which this cumbersome reduction-valve factor can be removed. One is by means of the "sparklets" used in some places to charge water for drinking purposes. Unfortunately the amount of gas contained in the sparklet is not adequate for prolonged use, and unless one has need for daily use of the test one has to change the sparklets each time. It requires a special attachment and a special reduction valve entailing the trouble of frequent replacement. When the sparklet is used the outflow of the gas being regulated by the reduction valve, it delivers a uniform flow of carbon dioxid gas in a manner satisfactory for our purposes.

Another plan is to transfer the gas from the large tank to a smaller tank without a reduction valve as is ordinarily employed in gas anesthesia. Such a smaller tank can be easily fastened to the examining table in the manner illustrated below, and within a few minutes at stated intervals the tank can

be refilled when the gas is reduced to low ebb and low pressure. This method is one which I have used and find it satisfactory as it ensures in the best possible way a uniform flow of the gas under a constant pressure rate. If oxygen is used it may be taken from the tanks in ordinary commercial use; those with a fine valve and circular handle (not a small lever) are preferable. I have used this method in several hundred cases and have found it most serviceable. Once the apparatus is assembled, the actual operation in the method of transuterine insufflation may be controlled by a single examiner.

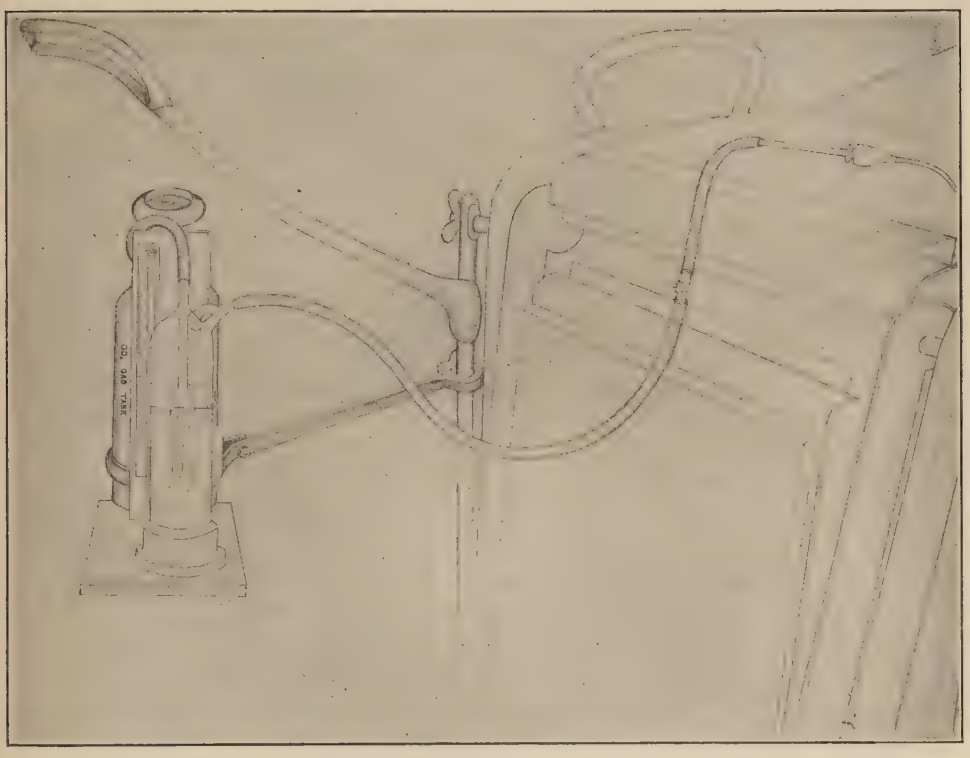

Fig. 1.—Author's Apparatus for Uterine Insufflation to Test Tubal Patency.

Many references have been made to the necessity of having one or more assistants during the procedure, and the uterine cannula has been modified in a number of ways, some even devising self-retaining instruments so as to liberate one hand of the examiner for other purposes. In the technic as employed by those of us who have started with the method from its early inception, the cannula and bullet forceps may be handled by one hand while the other hand is free for other purposes. I have on many occasions introduced the cannula into the uterus and left the cannula and bullet forceps resting on the lower leaf of the speculum without steadying either during the insufflation, thus leaving both hands free. In my hands it has seemed to be a very satisfactory, simple procedure requiring no extra assistance.

A number of modifications have been made of the test, practically all of

them calculated to simplify the "Rubin test." Thus the record syringe varying in capacity from 20 to 150 c.c. has been used by different operators. Others prefer the rubber bulb with a metal cannula or with a glass cannula, either of which is provided with one outflow and no manometer or with a T-shaped branch to which a manometer is attached. In this apparatus naturally air is the medium employed. When the record syringe is used it may be filled with carbon dioxid or oxygen gas according to the preference or facilities of the operator. When the syringe or bulb is used in connection with a manometer there is additional evidence of patency or non-patency by the rise and fall of the pressure reading. When no pressure gauge is used this evidence is lacking. In my original paper and in later publications I stated that in order to prove patency of the tubes there must be evidence in three directions: First, there must be a drop of pressure within certain limits during the insufflation; second, the patient must complain of shoulder symptoms; third, there must be roentgenoscopic proof of the presence of gas in the peritoneal cavity and most conveniently this may be seen under the diaphragm as a subphrenic pneumoperitoneum. When any one of these is absent one cannot be absolutely certain of the patency of the tubes.

1. If pressure alone is depended upon there may be a very fine leak along the cervical canal which might be inaudible to the examiner. There may be a fine leak in the apparatus itself, in the tubing or the attachments, and if not enough gas is introduced there will be absence of shoulder symptoms which in these simplified methods are commonly depended upon to demonstrate the fact of patency of the fallopian tubes.

2. The matter of the quantity of gas to be insufflated is of great importance especially when the small bulb or small syringe is used. It has been demonstrated repeatedly that at least 10 to 15 c.c. of gas under pressure is required to pass through the tubes. With the possibilities of leakage, back along the cervical canal, this small quantity of air can frequently lead to error. Even where the manometer shows a decline in pressure at a certain point this decline may be accounted for by a leak at the point of attachment between cannula and bulb or along the cervical canal or at any of the attachments in the apparatus. As long as the gas is not under appreciable pressure a minute defect in the apparatus may be responsible for the negligible amount of leakage. As soon as the pressure is raised to a point sufficient to overcome uterine and tube resistance the gas escapes through the tiniest defect. This is very well illustrated in the difference between allowing air or gas under the same pressure-flow ratio to pass into a collapsible, easily distensible rubber balloon with a capacity, let us say, of 500 c.c. and a thick, less distensible, and more resistant hollow muscular organ with a much smaller capacity, as the uterus. The latter will take 10 to 15 or 20 c.c. registering pressures varying from 20 to 200 Mm. Hg, while this same amount in the balloon would up to that point practically register atmospheric pressure. The collapsible balloon may contain 10 or 15 c.c. of air though there be a small rent in some part of it. Again it must be remembered that the uterus reacts against the inflow of gas by contracting. This it does in the presence of patent or non-patent tubes. When

the tubes are open the gas flows into the peritoneal cavity and no more than 20 to 30 Mm. Hg is required to keep up the flow through the open fallopian tubes. When there is no yielding point of escape for the gas the pressure will continue to be high as long as the flow remains constant.

3. *Concerning shoulder symptoms;* pain in the shoulders after insufflation are pathognomonic. Yet there are a certain number of women, neuropathic in type who, in order to be accommodating, would reply affirmatively to the question as to whether they had pains in their shoulders. It is therefore absolutely necessary to check up this symptom by seeing the gas underneath the diaphragm by fluoroscopy. A roentgenograph may be insisted upon in doubtful cases when one or other of the factors involved in this diagnostic procedure has not been absolutely definite and clear.

4. Fluoroscopy may fail to show a small amount of gas while the x-ray plate can clearly demonstrate a slight subphrenic pneumoperitoneum.

All these points require but a few minutes to ascertain and when all are present one has precise knowledge of the fact of tubal patency or tubal occlusion. It must follow, therefore, that all so-called simplified methods which do not produce a subphrenic pneumoperitoneum and which do not occasion shoulder pains and have no provision for manometric control of pressure cannot be said to fulfill the requirements of the test and are therefore unreliable. It goes without saying, of course, that in some women the simplest procedure will be satisfactory. For example, whether the syringe or bulb is used a sufficient amount of gas is insufflated to occasion shoulder pains without requiring confirmation by the fluoroscope and without the manometer. The ideal patient for the simplified transuterine insufflation is one who is not inclined to be nervous and particularly a thin individual. In such a patient a very small amount of gas or air will cause both subphrenic pneumoperitoneum and also shoulder pains. In more obese patients a greater quantity of gas is required to cause these symptoms, and this factor has been taken into account almost from the beginning of my work. The amount of gas insufflated is proportional to the weight, height, and waistline of each patient. Finally when one takes into consideration the great variability and uncertainty of the nervous sensibilities and psychic reactions of the average patient it becomes clear than in transuterine insufflation as in other clinical diagnostic methods one had best depend largely upon the objective, physical evidence in each case.

When we come to consider the refinements in diagnosis such as, for example, normal patency, moderate stenosis, unilateral or bilateral occlusion or stenosis, it is absolutely necessary to have uniform, continuous flow of gas under a steady pressure rate. This fact is not generally appreciated by those to whom the practicability of this diagnostic test has appealed so far, and I would like again to emphasize the diagnostic value and importance of using a gas under a constant rate of flow and controlled by a manometer. The siphon meter which I first recommended in 1921 (original monograph, Fig. 43) fulfills the requirement of volume measurement. It is automatic, accurate, and requires no handling once it is set up. The gas supply is provided by a small

tank filled with carbon dioxid gas. The valve in this tank is so graduated as to deliver a constant even flow of gas at any speed required.

Experiments on the specimen of the extirpated uterus has shown that in the normal uterus and tubes at least 40 Mm. Hg are required before the gas passes from the uterine cavity through the uterine ostia of the tubes and out at the fimbria. In many cases this initial pressure rise is from 60 to 80 or even 100 Mm. Hg. The speed with which this initial rise of pressure is registered depends upon the rapidity of flow of the gas. In other words, the faster the gas is introduced into the uterine cavity the faster will the initial pressure rise be reached. If this rate of gas is uniform, the same initial pressure rise will be noted every time an attempt is made in the same specimen to introduce gas through the tubes. Furthermore, clinical experience has shown that when the gas is allowed to enter the uterine cavity at a rate of 15 seconds to raise the mercury column to 100 Mm. Hg there is a certain degree of uniformity for the passage of the gas into and through the tubes. This rate flow also occasions the slightest discomfort to the patient and gives uniform figures for comparison not only in many different patients, but also in the same patient when repeated on several occasions in case patency is not established at the first test.

Another way of regulating the pressure is to make the rate of water displacement in the siphon meter the chief criterion for the gas transmission. Thus, for example, it has been found that when 100 c.c. of gas are allowed to flow through the siphon meter in one minute, the time-pressure-rate flow ratio is almost the same as when the rise of pressure requires 15 seconds or 20 seconds time to reach 100 Mm. Hg. The physical values are not exactly identical but practically and for clinical purposes they express the same thing. The chief significance of this criterion is the emphasis it lays upon *a slow and careful introduction of the gas* rather than an irregular, uncertain and haphazard insufflation.

When under these conditions the initial rise recorded exceeds 100 Mm. Hg, for example 120 to 160, and the gas nevertheless passes through into the peritoneal cavity, it must demonstrate the fact of some surmountable obstruction within the tube lumen, in other words a relative stricture. When on the other hand there is no uniform pressure-rate flow used and the other methods with *simpler* devices are depended upon, this high pressure may indicate normal patency or it may indicate anything at all. It will be borne in mind that no hand can produce a uniform pressure no matter how skilled. It is impossible to equal by hand pressure the inherent steadiness of pressure regulated by a mechanical device such as a fine valve. The significance of this fact was early appreciated in my work when I sought to simplify the apparatus and therefore resort was had to the siphon meter described in 1921. If one uses a syringe with a capacity of 150 c.c. one can introduce gas or air into the peritoneal cavity for all purposes, but it is not possible by this means to get the dependable uniform pressure rise which is obtainable by means of the gas tank. With the bulb this is even less possible.

In this connection it may also be stated that given these reliable factors

it is possible to determine whether or not both tubes are freely patent and whether one tube or both are stenosed. In the normally patent tubes there is no complaint of lateral pain. When the patient complains of unilateral or bilateral pain it may be taken to indicate pressure distention of a portion of the tube proximal to the point of obstruction on one or both sides. This clinical observation has been of aid in answering the ever recurring question as to which tube is closed or stenosed, and has obviated the necessity of introducing opaque substances to determine the same thing. It is impossible without using a uniform pressure-rate flow of gas to determine these facts.

Another point of equal importance is the matter of safety secured by careful attention to the rate flow. Three accidents have been reported to me, one of which was unforeseen but avoidable; and the other two were both due to ignorance in the use of the method of transuterine insufflation. In the first instance a spectator brushed by the lever of the tank and released a great volume of gas under a terrific amount of pressure. The cannula being in place within the uterus, the tubes were seen to rupture near the fimbriated end. Fortunately the patient was on the operating table, the abdomen being open. No harm resulted.

In another case the examiner allowed the gas to flow at a very fast rate and caused collapse by a terrific impact against the diaphragm of a large amount of gas rapidly delivered through the fallopian tubes. Bystanders watching this performance reported that the mercury within the manometer shot well up to the ceiling. It so happened that the patient selected for the test was a quartipara suffering from myocarditis and diabetes. The physician was a novice in the use of the method and had no clear idea of the procedure.

The third case was even less felicitous. This was a patient upon whom an amputation of the cervix had been performed some years before. The uterus contained several fibroid tumors, one, the largest, being the size of a large apple. The tubes had been converted into large hydrosalpinges. The physician not experienced with the test first dilated forcibly the cervical canal, insufflated the uterus with gas and then curetted. This is the order of the operation as stated by the physician in question. The patient became cyanotic and her respirations became embarrassed, anesthesia was not discontinued but the operator "quickly finished" the curettage. She ceased to breathe under the anesthetic and was not resuscitated. At the autopsy air was found in the pelvic veins, including those of the broad ligament, the inferior vena cava and the heart cavity. The tubes were found to be surrounded by adhesions widely distended and occluded at the fimbriated ends. The one tube was distended with blood and air. Without making further comment upon the operator it is clear that he was lacking not only in knowledge of the indications, contra-indications, and technic of transuterine insufflation but also in gynecological pathology. It is difficult to imagine what he could have expected to accomplish by the curettage in the presence of non-patent tubes, which fact he must have ascertained if the test meant anything at all to him. It is not conceivable that the test was done correctly and interpreted as indicating patent tubes in the presence of the disease actually present. Moreover, had the

insufflation been done by a competent man anesthesia would not have been necessary. Without this, the patient might have complained of faintness and the careful clinician would have desisted after a first unsuccessful attempt to force the gas through the closed tubes. On further inquiry into this case it developed that the operator had never performed transuterine insufflation before but had depended upon an interne to "shoot" the gas. Four attempts were thus made using high pressure each time.

In the original presentation of the test and subsequently it was emphasized that insufflation is not to be done in the presence of pelvic masses.

In this particular unfortunate case it may not be amiss to conjecture that the injury to the cervix occasioned by forcible dilatation of a stenosed cervical canal may have presented the avenue of entrance into the cervical veins and thence into the broad ligament, etc. Some of the gas held under pressure within the uterine cavity may have entered the general circulation after the endometrium was curetted, a fact demonstrated by Sampson with his bismuth experiments and in my own work. Too much stress cannot be laid upon this point of the necessity of slow, careful gas insufflation. It is striking that in the hands of the men who have employed transuterine insufflation according to all the rules of technic and indications, no such accident has occurred nor anything approaching a calamity and the number of insufflations may now be reckoned in the thousands. The two accidents just described have occurred in the hands of not only inexperienced but unqualified operators.

It has been urged particularly by continental authors that by using a small syringe, say 20 c.c. capacity, air embolism can be avoided because the uterine cavity permits of distention with 10 c.c. so that at most 5 or 10 c.c. would get into the veins. I have demonstrated that as much as 300 c.c. of gas can be introduced into the venous system without causing any harm provided, of course, the rate of injection is slow similar to that prescribed for transuterine insufflation. Nor does the amount of gas introduced via the uterus entail any essential danger within the peritoneum provided also that the rate of gas flow is slow and not in excess of 100 c.c. displacement per minute or faster than it requires to raise the mercury column to 100 Mm. Hg within 15 or 20 seconds time. On a number of occasions a large-sized pneumoperitoneum has been produced by the transuterine route, injecting a liter or more. This has not been recommended as a routine measure by me since the primary interest in insufflation has been in its specific diagnostic value as a test of tubal patency; and for this only a diminutive pneumoperitoneum is necessary and adequate. It is a question of proper judgment in selecting the cases and of competent skill in using the technic no matter how simple this actually happens to be. As with everything else in medicine, one should have precise knowledge of physiology and pathology in addition to a clear understanding of the object of any method in question. Simple as transuterine insufflation is and safe as it has proved in careful hands, it may nevertheless lead to disaster when misemployed by careless and unskilled hands. It certainly is not recommended as a procedure to the average practitioner who has not been trained in gynecological procedures.

The bulb insufflation or the syringe insufflation without a manometer cannot be subscribed to because of its unreliability, nor can either of these methods with the addition of a manometer compare favorably with the volumanometer and uniform rate-flow auxiliary. The so-called simplified methods have perforce had the effect of lessening the degree of care to be exercised in the tubal patency test—a lack of care which cannot so readily attend the original method because one at least pays attention to the description of the technic and rules to be followed. But no matter what method is employed scrupulous regard must be had for the indications and contra-indications, for the facts in physiology and pathology and with respect to the primary essentials of the technic itself, namely, slow and gentle gas flow avoiding trauma of any kind. *Trauma is so unessential* that the test is best carried out without any anesthesia; so little pain does it cause that the patient may have the test done in the physician's office. *This means, of course, that the case must be properly adapted for the test. There must be no bleeding present, no fever, no pelvic tenderness, tumors or purulent discharge. The patient must have no remote serious cardiac or respiratory disease.* It is obvious that aside from the possible dangers to such a debilitated patient there can be no good reason for prosecuting the test. These women are bad risks for pregnancy in any event and it is a rather idle pastime to subject them to transuterine insufflation. Yet in selected cases a diminutive subphrenic pneumoperitoneum even under these conditions can do no harm.

In case of doubt, it is well to take the patient's temperature before a thorough examination is made and to note the temperature at intervals for twenty-four hours after the examination. Experience with pelvic inflammatory disease has taught that in the presence of a subacute process, manipulation as by digital examination can evoke a rise of temperature. The same has been noted repeatedly in instances of conservative treatment where a patient leaves her bed too soon after an abatement of fever thus indicating inflammatory activity. The occurrence of menses with its attending hyperemia is a common cause of temperature rise in the course of adnexal disease. Other traumata of moderate or slight degree have been known to produce the same thing. In the interest of absolute safety, therefore, this added precaution may be taken and recourse may be had to the sedimentation test, which has proved of aid in pointing to latent or subacute inflammation.

In conclusion, the importance of gentleness in performing the test cannot be too emphatically stressed. The introduction of the cannula must occasion a minimum or negligible amount of pain or discomfort; it must follow the natural direction of the cervico-uterine curve as previously determined with sound and careful bimanual examination and must occasion no bleeding. When bleeding attends the insertion of the cannula, no further attempt should be made to go on with the test as it indicates an inflammatory condition of the endocervix and endometrium. This, to be sure, is a very rare occurrence, but it is better to defer the test for a more favorable time.

The time of preference has so far seemed to be from four to seven days after the complete cessation of the menstrual period. The endometrium is then

in the resting stage and is least liable to infection, though the latter is extremely remote in careful hands. By choosing the postmenstrual interval for uterine in insufflation it will be possibly always to avoid interfering with an existing uterine or extra-uterine pregnancy. This rule is of special value in cases of amenorrhea of shorter or longer duration where it is otherwise impossible, if the patient present herself several weeks after the last menstruation, to determine the length of gestation. As ovulation occurs not sooner than twelve to fourteen days from the onset of the last preceding menstruation, pregnancy cannot take place before this time and insufflation is theoretically and practically safest when done within a week after cessation of a regular menstruation. The theoretical possibility of endometrial dislocation as well as of embolism formation is also thus eliminated. Clinical and experimental observations have pointed to the advisability in any event of not exceeding a pressure of 200 to 250 Mm. Hg. Higher pressures have been employed by experienced hands in the attempt to open tubes that had been previously demonstrated to be stenosed or closed. *It will not do for the beginner in this work,* and goes without saying that *such attempts are best undertaken under the most favorable auspices.* Finally, by selecting the fourth to the seventh day, the therapeutic possibilities of the test become increased while more uniform results as regards the pressure-rate flow on the one side and tubal patency, stenosis, or occlusion on the other will be obtained.

LOCALIZATION OF THE SITE OF TUBAL OBSTRUCTION

The method of uterotubal insufflation has been developed by the addition of a kymographic attachment since 1925. With this aid, it has been possible to determine not only the presence of patency or non-patency of the tubes, but also to distinguish normal patency from markedly stenosed but permeable tubes. The presence of uterotubal spasm can also be diagnosticated. It has furthermore enabled us to recognize the points of obstruction: At the site of the tubo-uterine junction (intramural, interstitial portion); at the isthmico-ampullary junction; or at the fimbriated ends whether the obstruction be on one or both sides.

This has been made possible by careful study of the character of the symptom, pain, which associates tubal insufflation in the pathological cases, and of the manometric pressure findings as recorded on the kymograph.

In normal patency no pain is observed by the patient; only a slight discomfort is felt above the symphysis and referred to the uterus. When the tubes are closed at the uterine ends, this discomfort is increased and is appreciable. It lasts only during the minute or two taken up by the examination.

When the tubes are closed at the fimbriated ends, there is a sharp, bilateral pain, radiating well out to the flanks, sometimes darting down the thighs. When the tubes are closed at the isthmico-ampullary portions, there is pain just lateral to the uterus on either side. Unilateral pain points to complete closure or partial stricture of one tube when patency has been established by the presence of a subphrenic pneumoperitoneum, and a drop in the pressure.

In the absence of the other evidences of patency, unilateral pain, depending upon the severity and the distribution, points to an obstruction at or beyond the isthmico-ampullary portion in the one tube, the other being closed at the uterine end. The isthmus does not distend much with gas and when obstructed causes slight pain as compared to the very sharp pain experienced as a result of distention of the ampulla and fimbria.

These interpretations have been controlled and corroborated by uterotubal lipiodol injections. For practical purposes careful attention to these symptoms will obviate the necessity of uterotubal radiography. The latter may then be resorted to in the doubtful cases and when an operation to restore patency is desired.

RUPTURED ECTOPIC PREGNANCY

Shoulder Pains, a Symptom of Ruptured Ectopic Pregnancy.—The occurrence of shoulder pains in ruptured ectopic pregnancy has been noted in recent years, especially since shoulder pains have been frequently induced through the artificial production of subphrenic pneumoperitoneum in testing for tubal patency. These pains are present when there is a large extravasation of blood in the peritoneal cavity including an accumulation under the diaphragm. The patient in whom this symptom is present as a rule has fainted at the onset. In the recumbent posture, blood gravitates under the diaphragm and collects there as a *subphrenic hemoperitoneum.* If no further bleeding takes place the patient complains of severe darting pains in the shoulders. When bleeding is gradual and not associated with collapse, the patient may walk about for a while, thus allowing the blood to gravitate down in the deep pelvis.

This symptom is absent in the unruptured cases and in those complicated only by pelvic hematocele with or without syncope. In several of the patients observed, the shoulder pain was so acute as to suggest strongly a possible attack of cholelithiasis. The clinical history of delayed menses, associated by pelvic pain, spotting, and the finding of tender, enlarged adnexa or bogginess in the culdesac of Douglas, without lateral tenderness, help to distinguish ruptured ectopic pregnancy from perforated gastric or duodenal ulcer, appendix or intestine. From twisted ovarian cysts or torsion of tubes, from acute inflammatory pelvic lesions, the differential diagnosis should, in the presence of shoulder pains, render the diagnosis practically certain in favor of ruptured ectopic pregnancy.

Cullen's Sign of Ruptured Ectopic Pregnancy.—Cullen has called attention to the fact that in the presence of a large amount of free blood in the abdominal cavity, the umbilicus may be discolored. The discoloration varies from a bluish-black to yellowish-green and depends upon the degree to which the blood has broken down. Emil Novak has reported similar observations. This sign is rarer than the presence of shoulder pains which are not infrequent in the cases associating collapse.

The sedimentation test has proved of value in differentiating inflammatory lesions from non-inflammatory lesions in the pelvis. A blood sedimentation time of thirty minutes is the high limit of inflammation. When the blood

sinking time (erythrocytes) is below that level it usually points to the presence of an active inflammatory process. The more rapid the sinking time the more acute appears to be the inflammation. It is of aid in distinguishing the unruptured tubal pregnancy from acute salpingo-oöphoritis, a condition with which it is often confused. In ruptured tubal pregnancy, the sedimentation test shows the blood sinking time to be at a normal level for the first twenty-four hours, after which it becomes more rapid and simulates an inflammatory lesion; so that it can be of aid in distinguishing abdominal collapse due to peritonitis from that which associates intraperitoneal hemorrhage.

COMPLICATIONS OF PREGNANCY

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Late Hegar's Sign.—Under this title attention has been called to the fact that Hegar's sign is present for some time after the uterus has been emptied in early pregnancy. If a vaginal examination be made at this time the lower segment is plainly evident, the cervix is soft but may have closed immediately after the expulsion of the embryo, so that practically it does not admit the examining finger. The shape, size and consistency of the uterus is that of early pregnancy. Under these circumstances it is impossible for a physician from one examination, to know whether the patient is at that time pregnant or whether an embryo has very recently escaped from the uterus. The patient must be put under accurate and continual observation for a number of weeks; during this time if the uterus grows smaller and gradually assumes its non-pregnant condition, it is fair to infer that it no longer contains, certainly, a living embryo. It is true that a blighted ovum may be retained in the uterus indefinitely, but a living embryo cannot be present without continual uterine growth.

Should a menstrual period develop, the diagnosis that the patient is not pregnant becomes clear.

Joachimovits (*Monatschr. f. Geburtsh. u. Gynæk.*, 1924, Band 67, Heft 5), in his examination of 50 cases of abortion where the uterus was entirely emptied, found Hegar's sign clearly demonstrable in 2 cases, and present to some extent in 11 cases, five days after the escape of the ovum. There was slight hemorrhage in these patients but not sufficient to be of service in the matter of diagnosis.

That a dead fetus may be retained in the uterine cavity has long been known. Karlin (*Monatschr. f. Geburtsh. u. Gynæk.*, 1924, Band 67, Heft 5) reports 3 cases in one of which a dead fetus was retained in a woman suffering from carcinoma of the cervix, for one and one-half months from its death. Another woman with mitral lesion of the heart and toxemia, retained a fetus for a month after its death, while in a third case, a month after the death of the child stenosis of the internal os developed which made the emptying of the uterus difficult.

Diagnosis of Pregnancy by X-Ray.—This means of diagnosis, so valuable in other branches of medicine, is of decided importance in pregnancy. Its success will depend, not only upon the ability and experience of the operator, but also upon the perfection of the instrument employed.

Under ordinary circumstances several months at least must have elapsed before an accurate picture showing fetal bones can be obtained. With the average x-ray, five months is often as early as one can obtain accurate results, although under exceptional circumstances an earlier shadow develops.

The use of the x-ray to diagnosticate complications in pregnancy increases in value as time goes on. In a recent case of twin pregnancy, a positive diagnosis of the twin pregnancy was not clear. It was thought that one large child might be in the uterus or twins. The x-ray showed twin pregnancy but further demonstrated the fact that the twins were in such a position that should labor develop, they would inevitably become locked. The significance of this is apparent.

If one large child had been present, cesarean section was indicated as the pelvis was less than the average in size and the head had not engaged. If twins were present it was to be expected that as each twin is rarely of average size, vaginal delivery would readily occur; the presence of locked twins, however, in a primipara between 30 and 40 years of age, made cesarean section still the proper method of delivery.

X-Ray Obstetric Diagnosis Is Always an Interesting and Practical Subject.—Portes and Blanche (*Gyméc. et obst.*, 1924, 5) publish a paper giving the results of considerable work in this subject with a large bibliography and three pages of illustrations.

They found this method valuable in diagnosticating pregnancy before signs of fetal life could be recognized, in the diagnosis of multiple pregnancy, pathological pregnancy, mechanical obstacles developing during pregnancy which might influence labor, especially in the diagnosis of disproportion between the head and pelvis. They quote statistics of others who claim to have recognized pregnancy by this method at three and one-half months and four months, some at five months and in a series of 24 cases, in one-third of them before the fifth month. The writers studied 10 patients with 9 negative results and one in which they obtained a positive shadow. In diagnosticating twin pregnancy, error can be avoided by the use of the best apparatus in the hands of experienced persons, and if these precautions are taken the method is successful and of great value. In diagnosticating triple pregnancy, there are several cases upon record. Hydrocephalus and monsters can be recognized when the fetus has grown to considerable size. Regarding the question of diagnosticating fetal death in the uterus, there are very few results of practical and proven value in these cases. It is claimed that the recognition of disproportion between the size of the cranium and the size of its contents is positive proof of fetal death. Where maceration occurs, decalcification of the skeleton becomes pronounced and that can be recognized by the x-ray. Tumors complicating pregnancy would suggest examination by this method. In the second half of gestation the x-ray would show the fetal skeleton which would be contrasted with the outline of the tumor.

In ectopic pregnancy the x-ray can render service only after the fetal skeleton is sufficiently advanced to be clearly recognized; so in mechanical complications of gestation, all would depend upon the degree of ossification

present in the fetus. So much can be done by this method of diagnosis that it should be kept in mind in all important complications of gestation in which it offers a chance of success.

Clinical Significance of X-Ray Pelvimetry.—This is described by Thomas (*Am. J. Obst. & Gynec.*, 1926, 12: 543). He succeeded with remarkable accuracy in measuring the dimensions of the superior strait. This method requires no elaborate apparatus and may be used at any period of pregnancy. He obtains lateral views of the pelvis, giving the contour of the sacrum and the relation of the presenting part to the superior strait. Obviously this is of especial value in the less severe grades of rickets.

Estimation of Fetal Development by X-Ray.—Jardin (*Gynéc. et obst.*, 1926, 14) has used the x-ray in studying the development of fetal bones, finding that the center of ossification for the lower epiphysis of the femur appears at the beginning of the ninth month and is always present at term. The center for the upper epiphysis of the tibia appears at eight and one-half months and is always to be recognized at term.

One may conclude that a newborn infant weighing 5½ pounds or more, in length 18 inches, with centers of ossification in the lower end of the femur and upper end of the tibia, is at full term.

The child weighing more than 5½ pounds and longer than 18½ inches and showing ossification in the lower epiphysis of the femur is a full-time child. An infant less than 5½ pounds, 17½ inches in length, with a center of ossification at the lower extremity of the femur is in the beginning of the ninth month; where there is no center of ossification either in the lower end of the femur or upper end of the tibia, the weight less than 4½ pounds and the length less than 16½ inches, the child has not reached the beginning of the ninth month of gestation.

Serological Diagnosis of Pregnancy.—This still remains without satisfactory results. The Abderhalden test has long since been shown inaccurate. That disturbance of metabolism follows certain procedures in pregnancy which does not happen in the non-pregnant, is indirectly of some slight value, thus the injection of epinephrin in pregnant patients is followed by glycosuria. In pregnant patients the red blood-corpuscles are said to settle to the bottom of a container much more rapidly than those of non-pregnant, but these are conditions which give rise to inference only and are of little value for positive information.

The metabolism of pregnancy remains an unsolved problem in the very extensive and increasing literature. The fact that pregnant women lose in weight is of interest and various researches have been made upon this point. In a recent series of observations by Hirsch (*Monatschr. f. Geburtsh. u. Gynæk.*, 1924, Band 67, Heft. 5) in 170 pregnant patients, 53.5 per cent were below the average weight. The patients under observation for some time in the hospital, showed that there was a slight gain in weight until the sixth day before labor, from this to the fourth day the weight remained unchanged, and then occurred a loss so that when labor began, the average weight was 0.4 Kg. less than five days before labor. It is difficult to

find an explanation of this fact, but it may be of interest to note that the x-ray applied to the hypophysis in some patients produces a loss of weight.

An observation of some interest in this connection is made by Hess and Weinstock (*J. Am. M. Ass.*, Nov. 15, 1924) concerning the influence exerted by the diet of a pregnant woman, upon rickets in her offspring. By experiment upon animals the writers found that giving cod-liver oil during pregnancy did not protect the fetus against rickets when after birth the young were placed under conditions favorable for the production of rickets. At the Sloane Hospital for Women a number of pregnant patients were given cod-liver oil during the last two months of pregnancy; 28 patients could be observed and of this number, 15 had infants which developed rickets according to clinical criteria and 8 of these were shown to have rickets by x-ray examination. That the mother's nutrition has an influence in making the child susceptible to rickets is proved by the fact that premature infants are very susceptible to the development of the disease. Evidently the nutrition of the mother in pregnancy has little to do with the disease in the child and this is acquired after its birth.

Diagnosis of Early Pregnancy.—The diagnosis of early pregnancy by recognizing some alteration in the excretions of a pregnant patient has frequently been attempted. Bronnicoff (*Zentralbl. f. Gynäk.*, 1924, 44) reviews the literature of the subject as regards the diagnostic value of glycosuria produced by phlorizin in recognizing early pregnancy. His observations were made in 350 cases of various kinds and in all over 1000 tests were made in 300 women and 8 men. Phlorizin was given by intramuscular injection and in another series of 42 men by intravenous injection. By the intramuscular method 1 c.c. of a fresh solution (0.2:100.0) which was 2 Mg., was given in the morning in the gluteal region. After the injection the patient was told to drink water freely and then the urine was examined for sugar, three times at intervals of half an hour, if necessary it was taken by catheter. Before the injection, a control test was made of the urine to demonstrate the absence of albumin and sugar. In none of these cases was albumin present and the two cases which showed sugar in the urine, were eliminated from the test. In 73.8 per cent of patients in the first two months of pregnancy, the test was positive; in 26.2 per cent the test was negative although the patient was pregnant. In 40 patients who had temporary amenorrhea, 29 gave positive reactions and 11 negative. In 122 patients known to be pregnant, 82 were healthy, 20 tuberculous, and 20 anemic. Among the healthy patients 61 gave positive tests and 21 negative tests; in the tuberculous 14 were positive and 6 negative. In the anemic 10 were positive and 10 negative.

Cases of incomplete abortion from six weeks to the third month, were also examined, 60 in all, of whom 40 gave a positive and 20 a negative test. In order to control the test 70 cases, 60 of these not pregnant and 10 patients who had passed the menopause, were given this test and with the exception of three, aged 45, 55, and 60, the results were negative. The three patients had prolapse of the uterus and they gave a positive reaction. Twenty-two

patients were examined during the menstrual period and 13 gave a positive reaction.

When men were examined 72 per cent gave positive and 14 per cent a negative test. This percentage is the same as that obtained in the examination of women.

These experiments are an illustration of the difficulty in diagnosticating pregnancy because of disturbed metabolism. They should lead to caution in placing too much reliance upon technical results.

Contour Abdominal Measurements for Pregnancy.—Pendleton (*Am. J. Obst.*, 1926, 12 : 390) has found that in some cases one can predict labor by measuring the contour of the abdomen; after the twenty-fourth week this is a fairly accurate method. When the menstrual history has been unusual and confused, this method should be employed with that of Nagel as a check, the position and attitude of the fetus determined, the accuracy of the method being greatest where the vertex is on the left side; marked variations are observed when the vertex is posterior. This method does not enable one to decide upon the course of treatment in an unusual posterior position.

When the pregnancy is abnormal or labor is abnormal, the contour measurements are greater than in the average. When the fetus descends into the pelvis, the uterus contracts, or where the uterus has been suspended, the contour measurements are smaller than the average. The smaller measurements are more accurate than those above the average.

The Respiratory Function in Pregnancy.—This was studied by Bombani (*Ann. di ostet.*, 1923, 10 : 528) in a nervous pregnant woman who had influenza in 1918 and at four months pregnancy had obstinate and severe dyspnea. The urine was negative, the blood normal and abdominal organs seemed healthy. There was some tendency to exophthalmos but the pupils reacted well. The blood showed over four million red cells and 7000 white cells and 75 per cent hemoglobin. Various drugs were given to the patient and the carbon dioxid content was studied. While some of the observations are interesting, they throw no definite light upon the problem.

Relation of Embryo and Mother.—New light is given to our study of the relation of the embryo and the mother, by Teacher (*J. Obst. & Gynæc. Brit. Emp.*, 1924, 31 : 2). This contains some exceedingly good and clear illustrations, showing the intimate relation between the villi of the chorion and the maternal blood, and also the relation of the maternal blood to the ovum before the intervillous spaces are formed. His study shows a remarkable connection between the blood of the mother and the embryo which must render the condition of the mother's blood a potent factor in influencing her offspring.

The effort has been made to show the "Relationship between the Area of Placental Attachment and the Birth Weight of the Child" by Lavake (*Am. J. Obst.*, July, 1924). He concludes from his study of the subject that the diet of the mother influences little or not at all the size of the child, it is therefore useless to limit the diet in the mother to lessen the fetal size or to push her nourishment excessively with the hope of stimulating the growth of the embryo.

Toxemia of Pregnancy.—The toxemia of pregnancy is always a subject fertile in literary production. Many obstetricians believe that the toxemia of pregnancy is essentially one process, differing in manifestation in different organs and under different circumstances. This view seems logical and is useful in presenting the matter to students for study.

Some, however, strongly dissent from this opinion, among them Cook (*Brit. M. J.*, March, 1924, in the "Hunterian Lecture on the Toxemia of Pregnancy"). His contention is essentially that until toxemias are clearly recognized, demonstrated and analyzed, he declines to believe that they exist as decisive factors in what is termed by some the toxemia of pregnancy. He questions the variations from the normal which are alleged to exist in calcium content of the blood-serum in pregnancy, and he does not accept the findings of those who have detected in the blood-serum marked variations in the healthy pregnant patient and in those threatened with eclampsia, having albuminuria or who have eclampsia.

The acidosis factor he believes of little importance and in eclampsia the inorganic constituents are very little changed. Biochemical investigations have given us no accurate knowledge. The average case of albuminuria he asserts shows no symptoms. He believes that mechanical pressure of the growing uterus interferes with the function of some of the excretory organs. The value of bleeding in toxemia is its effect upon blood-pressure. The pernicious nausea of gestation is caused by many factors, among which starvation is very important. The influence of the nervous system is paramount, and he would not withhold food from these patients.

The majority of evidence, however, does not support his contention that there are no essential alterations in the blood urea and in the metabolic processes of the mother who has toxemia. It has been thought that in many cases of toxemia of gestation, the death of the fetus *in utero* is favorable for the mother. Recent studies in this connection indicate that where the fetus dies in the uterus and the mother's toxemic condition immediately grows less, the woman has no definite lesion of the excretory organs, especially the kidneys; but if albuminuria and other signs of toxemia persist after the death of the fetus, structural changes have developed in the excretory organs.

Pathology.—In the *American Journal of Obstetrics*, 1926, 12:792, Bell gives the results of autopsies in 10 cases of the toxemia of pregnancy, where this condition became evident during the last four months of gestation. Of these patients, 5 had convulsions. The illness had been present for varying intervals and jaundice was found only once. In one patient the lower surface of the diaphragm was covered by subperitoneal hemorrhage. This is often seen in the infants of toxemic mothers, dying shortly after birth. Fluid was found in the abdomen in 3, and in half of the cases, in one pleural cavity. This fluid was purulent in one case, bloody in 2 and clear in 2. Pulmonary conditions were present in half the group and these lesions extended from simple congestion to the development of nodules. Microscopic study of the lungs showed congestion with edema, various forms of bronchitis and bronchopneumonia, hemorrhage and abscess. The size of the heart was not propor-

tionate to the weight of the individual, a comparatively small woman having the largest heart.

There was fluid in the pericardium in all the cases, in one purulent, in two bloody. In a few the myocardium was considerably softened. The coronary arteries and aorta showed no lesions of importance. The color of the spleen varied from pinkish gray to dark brown and corpuscles could be discerned in 8 of the patients. None of these patients had had the appendix removed and none of them had acute appendicitis. Beyond the presence of bile-stained fluid in the stomach, the digestive tract seemed normal, so were the adrenals and the pancreas. The capsule of the kidney separated easily in these patients. The kidneys were pale and the cortex often swollen.

The condition of the liver varied greatly, in some there was obvious congestion, in others localized fatty infiltration, acute yellow atrophy, infarction, necrosis with hemorrhage and in others the portal spaces were filled with cells.

The Eye.—The condition of the eye in the pregnant toxemic patient is always interesting, and Cheyney (*J. Am. M. Ass.,* Nov. 1924) reports his experience in examining patients at the Boston Lying-In Hospital. He found that retinitis complicating pregnancy is not more common in primiparæ than in multiparæ. When changes occur in the fundus they usually develop in the last three months of pregnancy but rarely recur. If the toxemia of pregnancy is acute, eye changes do not recur; but if the pregnant woman has chronic nephritis, eye changes persist and return often with increased severity, in subsequent pregnancy.

In 8400 patients in the clinic at Christiania were 680 whose eyes were examined and among these were 40 cases of retinitis; 82 per cent of patients with retinitis had chronic nephritis and 18 had an acute toxemia of pregnancy. The reports of different observers do not agree concerning the permanent damage to vision. In one series, but 65 per cent of patients having retinitis were able to read after the pregnancy had ended. In another series 28 per cent had normal vision, 58 per cent damaged vision, and 14 per cent were blind after pregnancy ended. The writer believes that if a toxemic patient shows retinitis the chances are 4 to 1 that she has developed kidney lesions and she should be carefully followed for over a year after the termination of pregnancy. Unless the urine and blood-pressure are absolutely normal during this time, repeated pregnancy must not occur. It is true that cases of chronic nephritis can be tided along for considerable periods, and with these patients retinitis processes as well; but this does not lessen the gravity of the situation.

So far as treatment is concerned, if retinitis is discovered at any time previous to the last two weeks of pregnancy, the pregnancy should be terminated. Patients having retinitis and going to term, show a mortality of 15 per cent, and 20 per cent blindness in the survivors. Where the pregnancy is interrupted, the mortality falls to 4 per cent and the percentage of blindness to 6 per cent. Retinitis may be caused by toxic blood or may be secondary to changes in the circulatory system such as increased blood-pressure, slowing of the circulation, and hemorrhage.

In studying pregnant patients the writer endeavored to ascertain whether

by examination of the eyes he could distinguish an acute toxemic case from the nephritic. Where the condition was one of acute toxemia it should theoretically be easy to differentiate from chronic nephritis, but practically it is impossible to do so, for lesions in the retina may vary in character, extent, and development in both toxemia and nephritic patients.

That it is important to have the eyes of pregnant patients examined, there can be no doubt and in many cases a valuable indication of the toxemia of pregnancy may thus be found. In the writer's observation the spontaneous interruption of pregnancy in these cases is often a conservative process not only to save the life of the mother but frequently to preserve her vision.

The Liver.—That sudden death after labor is due to a degenerative condition of the liver and a severe toxemia is illustrated by the report by Schickele (*Gynéc. et obst.*, 1924, 1) in his clinic at Strassburg. His first patient was aged 35, second pregnancy, spontaneous labor followed by some hemorrhage and manual removal of the placenta. There had been very moderate anesthesia with ether. After delivery the patient became greatly cyanosed and died in an hour. At autopsy the liver was extensively disintegrated and necrotic. Kidney lesions were not important.

The second patient was a young woman in labor fifteen hours, delivered by low forceps application, the child was living and vigorous but the mother died four hours after labor. Autopsy revealed an extensive lesion of the liver with embolism, no lesions in the heart or other organs. The liver was extensively disintegrated. On examination the capillaries were dilated and there was multiple hemorrhage and various stages of cellular degeneration. The kidney lesions were very slight.

A third case was in her fourth pregnancy with rachitic pelvis. Cesarean section under spinal anesthesia was done. Just after the child was delivered, the patient became livid, respiration failed, and death ensued. The spinal anesthesia was considered as the cause of death. At autopsy the liver showed lesions of yellow atrophy.

The toxemia of pregnancy with especial reference to liver function was studied by Berkeley and his associates, as reported in *The Journal of Obstetrics and Gynæcology of the British Empire*, 1924, 31, 1. He examined cases from a number of hospitals and completed his paper by tables and statistics. He was especially interested in two methods of research: One, the estimation of the blood urea and blood non-protein nitrogen; the other, the investigation of the urine. In another group of investigations which he found more important, were the tests of hepatic function. For this purpose he used Fouchet's test for bile pigment in the blood. This is based upon the circumstance that damage to the liver cells causes them to lose the property of converting urobilin into bile pigments; urobilin then accumulates in the blood and is excreted in the urine and can be recognized. Fouchet's test consists in taking the serum of the patient examined, putting three drops on a white porcelain surface and adding three drops of the reagent employed. This reagent is 20 c.c. H_2O, 2 c.c. of 10 per cent ferric chlorid, 5 Gm. trichloracetic acid. If the reaction is positive, a white coagulum is formed by precipitation of the serum proteids by the tri-

chloracetic acid and the coagulum turns a greenish blue color, reaching a maximum in about twenty minutes. He employed other tests but Fouchet's he believed was of considerable importance.

This paper should be studied in detail by those especially interested in the toxemia of pregnancy.

The purpose of the study was to determine whether an indication could be found which would form a reliable guide for the interruption of pregnancy and it is believed that the best indication and perhaps the only safe one for inducing premature labor in cases of albuminuria of pregnancy, is the test of hepatic function described. Even if the blood urea and non-protein nitrogen tests are as reliable as they are considered, they are complicated, requiring expensive apparatus and high technical skill, while Fouchet's test is simple and can be readily applied.

Insulin in the Vomiting of Pregnancy.—In line with this investigation is the report of a case of pernicious nausea of pregnancy with acidosis, treated by insulin (Lequeux, *Bull. Soc. d'obst.*, 1924, 5). The patient was aged 29, good general health. Eight months after marriage she had some treatment for the pelvic organs and after that pregnancy developed. Pernicious nausea was present with very great tenderness over the abdomen. Apparently menstruation returned and an early abortion had probably taken place. The second pregnancy was followed by pernicious nausea with severe acidosis, the coefficient being 68 per cent and acetone abundantly present in the urine. Treatment by injections of adrenalin and suprarenal extract did little or no good. Glucose was given by rectum. This treatment seemed to be successful for some time when the patient again became worse and was again better with the treatment. She gave birth to a child deficient in weight but made a recovery. In the next pregnancy nausea was treated by ovarian extract successfully with the successful termination of pregnancy. In a following pregnancy pernicious nausea was again present and the patient was treated by the administration of glucose and the Lily preparation of 10 units of insulin. She grew better, then worse, but her physicians were able to carry her along in pregnancy until a uterine hemorrhage occurred. A dilating bag was then placed in the uterus and under anesthesia a living child delivered by version.

In a recent number of the *Journal of the American Medical Association,* Thalhimer reports his experience with glucose and insulin in the pernicious nausea of early pregnancy. He gives by intravenous injection 1000 c.c. of 10 per cent pure glucose and also 10 units of insulin are administered. This treatment was repeated in these proportions three times in severe cases with good results. His series of cases would aggregate a considerable number.

In a case of pernicious nausea and toxemia at about seven months pregnancy in a multipara who had had toxemia in each of five previous pregnancies, the writer employed the intravenous glucose and insulin treatment. The uterus expelled its contents in this case. The first administration of glucose and insulin was followed by improvement, the second was followed in a few hours by high fever, coma, and death. Autopsy showed degenerative changes in the liver and kidneys.

Thalhimer (*Surg., Gynec. & Obst.*, Aug. 1924) gives the results of some recent researches in the laboratory of the Columbia Hospital of Milwaukee in the insulin treatment of the toxemic vomiting of pregnancy. He quotes 3 successful cases under the care of physicians other than himself and all these showed marked ketonuria and one had acidosis with carbohydrate combining power of the blood-plasma of 35. Three hours after an intravenous infusion of glucose and insulin, the blood-plasma combining power was 48 and nineteen hours later 69. Insulin forces the body to oxidize to the utmost glucose and this results in consuming the products of incomplete fat metabolism; the ketonuria is thus lessened and reduced. The blood-plasma carbon dioxid combining power is raised, acidosis ceases, and the patient improves. A diet rich in carbohydrates is then given. That pregnancy causes an abnormality in carbohydrate metabolism, the writer believes is clearly shown. The results of treatment are that the patient's urine is free of acetone in one or two hours and the alkali reserve raises about ten points. An excessive amount of acetone reappears in the urine in eighteen to twenty-four hours, but unless the patient becomes worse, it may be disregarded. Carbohydrate food should be administered but no fat and plenty of fluid. After vomiting has ceased for twenty-four hours, the patient may take any food desired except fat, and the carbohydrates should be in abundance. The blood should be examined at least twice.

One patient only had an insulin reaction and she responded immediately when 3 Mm. of adrenalin were given hypodermically and two glasses of milk were administered by the mouth.

Thalhimer's method of preparing the glucose is described and the apparatus for administration is reproduced in an illustration in his article.

Sachs (*Med. Klin.*, April 15, 1927) uses small injections of 5 units twice a day, and progresses to twice daily of doses of 20 units. He does not precede this by giving carbohydrates, and considers this a point of importance. Hypoglycemia never appeared. The patients immediately improved, ceased to vomit, were able to take food and gained weight.

The writer has no explanation for the action but believes the effect upon the mind produced by the injections is a considerable factor.

Toxemia of Pregnancy as a Cause of Mental Disease.—That the toxemia of pregnancy is the cause of mental disease is demonstrated by Bourne (*J. Obst. & Gynæc. Brit. Emp.*, 1924, 31 : 2). He was able to study with a fair degree of accuracy 61 cases of insanity. The two great causes of this condition are the toxemia of pregnancy and septic infection. It is interesting to note that patients having eclampsia usually recover more rapidly and often more completely, than those who had toxemia which did not end in eclampsia. This is also true as regards the mortality; the mortality of eclampic patients is less than that of toxemic cases in which convulsions do not occur. Seventy-seven per cent of eclamptic patients had insanity for a short period after pregnancy terminated and then recovered their mental health. In cases, however, where the toxemia did not clear up, repeated pregnancy was accompanied by repeated attacks of insanity.

At the Bellevue Hospital, Gregory (*Am. J. Obst.*, Oct. 1924) studied 118

cases of mental disease complicating parturition. More than half were called manic depressive psychoses. This is stated to be a constitutional disorder with a definite history and usually terminated favorably.

Sepsis.—Latent sepsis as a factor in causing the toxemia of pregnancy was the subject of a paper by Ivens (*Brit. M. J.*, June, 1927). Her patients were treated at the Liverpool Maternity Home and a number of cases are narrated.

Coliform organisms with pus and sometimes blood were found in the urine. In some a non-hemolytic streptococcus was present, in others *Staphylococcus albus*. One case of pernicious nausea of gestation was septic, another had jaundice, another accidental hemorrhage, and in each of these it was apparent that sepsis played a part in producing the final pathology.

Anemia.—Attention is called to the severe anemia often accompanying the toxemic conditions in pregnancy by Schneider (*Monatschr. f. Geburtsh. u. Gynæk.*, Band 65, Heft 6, 1924). It has long been known that hemolysis may result in these cases and may be so severe as to become rapidly fatal.

Acetonemia.—That acetonemia may threaten death to a pregnant woman has been shown by numerous reports on the subject of the toxemia of gestation. Rowland (*Bull. Soc. d'obst.*, 4, 1924) reviews the literature of the subject and reports a case in detail in which the patient had a very severe toxemia resembling encephalitis lethargica in which acetone seemed to be the principal agent. The interruption of pregnancy was successful in this case in rescuing the mother.

Epistaxis.—At a meeting of the Section of Obstetrics, Royal Academy of Medicine of Ireland, February 4, 1927, Solomons, Master of the Rotunda Hospital, called attention to engorgement of the cavernous tissues of the nose as a symptom of pregnancy and the rarity of epistaxis. He reports the case of a primipara in the twenty-sixth week of pregnancy, admitted to the Rotunda in a toxic condition. The symptoms cleared to some extent and the patient was discharged but returned three weeks later with such severe epistaxis that he was obliged to tampon the entire posterior nares. Urine was highly albuminous, blood-pressure 240. Abdominal hysterectomy with spinal anesthesia was performed, morphin and scopolamin were given before operation and were so effective that stovain was not needed. The operation was performed without disturbance; on the following day the nasal tampons were removed. The patient was given water only, but on a holiday was unfortunately given an abundant meal which caused disturbance of vision and examination showed retrobulbar paralysis. On a very restricted milk and water diet the patient improved and was transferred to a general hospital.

Recurrent Toxemia of Pregnancy.—Young (*Brit. M. J.*, Feb. 12, 1927) in a paper read before the Edinburgh Obstetrical Society, stated that eclamptic phenomena are caused by disturbance of the toxic elements rapidly elaborated in a mass of dying placenta. It has also been shown that extremely toxic materials such as histamin and tyramin might be produced by disintegrating tissue. If the placental lesions causing these poisons, extend over a considerable area of the placenta, they might cause an immediate termination of preg-

nancy by abortion, premature labor, accidental bleeding without toxemia, but if the damage is less well-developed and less marked, the fetus might continue to live and there would be time for the development of the toxic elements which cause eclampsia. This view finds support in the fact that direct damage to the fetus does not occur from the eclamptic process of the mother; and that on the other hand a severe eclampsia may suddenly subside after the intra-uterine death of the fetus and the consequent complete detachment of the placenta. In 220 successive cases of toxemia and accidental hemorrhage in parous women, these statements were illustrated by the study of the history in eclamptic cases. The recurrence of eclampsia or the toxemia was found in over 30 per cent, and this is evidently a low estimate. In 40 per cent there was a tendency to the recurrence, in successive pregnancies, of abortion, premature labor, accidental hemorrhage or stillbirth.

These morbid processes arising in the patient and damaging successive pregnancies, may be primary or acquired. In many of the damaged pregnancies, there is no toxemia. In many cases of accidental hemorrhage, toxemia is absent. It is present in from 40 to 50 per cent, and even in patients dying as the result of hemorrhage, there may be no evidence of toxemic changes in the liver or kidney.

Where the damaged placenta was retained within the uterus, the toxemia was intense. The same toxic sequence occurred in 32 per cent of the cases. Placental damage was the primary cause of toxemia and the interruption of pregnancy.

The recognition of the frequent occurrence of true eclampsia, toxemia, abortion and premature labor may necessitate revision of the views held regarding nephritic toxemia. It has been believed that there were two groups of late pregnancy toxemias, the eclamptic or non-recurrent, and the nephritic or recurrent, but this distinction does not prevail. The small number of cases of kidney disease acquired after pregnancy, as in scarlet fever, are to be readily separated from others. The kidney damage in the late pregnancy toxemias was secondary to the development of disease in the placenta.

In the *California and Western Medicine,* 1926, 25: 333, Von Geldern studied the records at the Stanford Clinic of San Francisco of 27 women with toxemia of pregnancy who subsequently became pregnant. Of these one or more normal pregnancies followed the toxic one in 13; there was a return of the toxemia in 38 of 61 subsequent pregnancies. Among 135 patients, 25 had convulsions, of whom 21 were primiparæ. The maternal mortality in eclampsia was 16 per cent, the fetal 20 per cent. So far as diagnosis went in 14 cases of recurrent toxemia, 4 had or developed a chronic nephritis, while 10 had no kidney lesion; one of the 4 with chronic nephritis had four toxic pregnancies and died following a cesarean section in the nineteenth week, because of chronic nephritis. Another had three toxic pregnancies with deficient kidney function; two years after her last delivery there was much albumin in the urine and blood-pressure 230 systolic and 150 diastolic. In each pregnancy the symptoms became more severe and developed at an earlier period of the gestation. Where cases have chronic nephritis complicating pregnancy, the

symptoms of toxemia appear earlier and with each succeeding pregnancy at an earlier period. The pathological changes in the kidneys frequently noted, completely disappear, marked hypertension continues and function of the kidney is deficient.

Where there is recurrent toxemia without permanent kidney damage, it is hard to give a prognosis. Out of 10 such cases, 7 were carried through their last toxemic pregnancy and labors satisfactorily. In 3 others where the outcome was unfavorable, it was impossible to tell whether pregnancy in such a case could be continued without risking the life of the patient.

Venereal Disease in Pregnancy.—This was the subject of a paper by Browne (*Brit. M. J.*, August 13, 1927).

As regards treatment, four main principles should be borne in mind. It should commence as early in pregnancy as possible, or better still a full curative course of treatment for syphilis is to be completed before pregnancy. In every pregnancy such a patient should be treated by arsenical compounds, although she may seem to have been completely cured. It is safe to continue treatment up to the actual confinement. Arsenic and mercury or bismuth should not be combined because they tend to damage the kidneys. If there is no albuminuria, bismuth and mercury may be given in alternation. When albuminuria is present, it may be necessary to stop all treatment except potassium iodid.

He obtained the best results in syphilis by the use of novarsenobenzol intravenously, the dose varying from 0.3 to 0.75 Gm. Injections once weekly are continued until six or eight are given, with a careful watch for albuminuria. During the following month 10 Mm. of gray oil should be given, injected into the muscles of the buttock once weekly, with massage. As an alternative, twice weekly, bicreol of bismuth should be given. The condition of the teeth must be carefully watched and these courses of arsenic and mercury and bismuth may be given in alternation until pregnancy ends.

Eighteen months of treatment after delivery are required and it is safer to continue treatment for a year after all tests are negative. In each pregnancy antisyphilitic treatment should be repeated. Although salvarsan before and during pregnancy gives the best results for the child, there is no guaranty that the child will not be a congenital syphilitic.

As regards the treatment of gonorrhea complicating pregnancy, the difficulty is to bring the antiseptic into immediate contact with the gonococcus. Saline solution in cleansing the genital tract is as good as anything. Preparations of silver or 1 per cent picric acid are useful, a 1 per cent silver protein is also employed. Medicated urethral bougies have given good results. In some cases an astringent dusting powder is often useful. Local treatment is usually required twice weekly in clearing up the discharge.

Detoxicated vaccines, beginning with a dose of five thousand million repeating weekly and gradually increasing to fifty thousand million, may be continued until the end of pregnancy.

Douching is dangerous and should be avoided. The methods of treat-

ment described usually result in curing gonorrhea before labor and avoiding complications during the puerperal period.

Gonorrhea.—Davis (*Urol. & Cutan. Rev.*, Dec., 1926) estimates the frequency of gonorrhea in pregnant women as 22 per cent and that of syphilis as 3 per cent. One cannot rely upon laboratory findings for the diagnosis because a chronic gonorrheal discharge is often mistaken for leukorrhea. The patient should be examined several times during pregnancy; a discharge not due to chronic gonorrhea will clear up, with proper douching, in a few days. If it is caused by gonorrhea, it will return if the treatment is neglected.

His best results were obtained by vaginal douches of bichlorid of mercury, 1 : 4000, at first twice daily, then once daily. After the discharge has ceased the douches are given every other day, then twice a week, but the patient should remain under observation until delivery.

Ophthalmia neonatorum is very rare with this treatment; 1 per cent silver nitrate in the child's eyes was used. The entire body of the infant was then washed in a bath of 1 : 10,000 bichlorid of mercury and the child placed in a sterile blanket.

Syphilis.—The question of syphilis in pregnancy remains, as always, of great importance. In a paper in the *British Medical Journal*, November, 1923, Roberts states that in England and Wales 10 per cent of all marriages are complicated by syphilis and in these families three-quarters of the children are infected and one-third of the pregnancies end in fetal death. If syphilitic children are born alive, three-quarters die in the first year and the mortality later is very high.

Diagnosis.—In diagnosis the Wassermann reaction is of value but it is not absolutely conclusive. In seven-eighths of the cases a positive Wassermann in the mother means syphilis during pregnancy. So far as the period of pregnancy in which infection is most fatal for the child is concerned, if the mother becomes syphilitic before the end of the fifth month, the child does not escape; at the fifth or sixth month, there is 50 per cent chance for fetal mortality or fetal life, but if the mother contracts syphilis after the seventh month of pregnancy, the child escapes. The earlier in the pregnancy the mother is infected the more likely is the pregnancy to be interrupted. Multiparæ resist infection better than primiparæ.

Syphilitic pregnant women suffer considerably from headache, neuralgia, and insomnia, which are more or less relieved by appropriate treatment. During pregnancy, for primary and secondary signs, prompt treatment should be instituted. If a clinical diagnosis of syphilis can be made, no matter what the Wassermann reaction is, the mother should receive arsphenamin. If the disease is latent, neoarsphenamin should be given in weekly injections increasing to the twenty-eighth day, then ceasing for a week while other remedies are given. During this treatment the urine should be frequently examined to detect irritation of the kidneys. Pain should be avoided and the patient's teeth should be cared for. The dosage in this treatment is 0.03 Gr. in the beginning increased to 0.06 Gr., the treatment stopping for a week every three or four weeks. During the entire time of treatment 1 Gr. of mercury in chalk should

be taken three times daily, and from 7 to 10 Gr. of potassium iodid t.i.d. from the tenth to the twelfth and twenty-sixth to the twenty-eighth week.

The Wassermann reaction was studied at the Edinburgh Royal Maternity Hospital; Browne (*J. Obst. & Gynæc. Brit. Emp.*, 1923, 4) found that in old syphilis the only evidence obtainable during pregnancy was the Wassermann reaction in 75 per cent of cases. Primiparæ did not resist infection as well as multiparæ, which has been shown by other observers.

There was no definite evidence that the Wassermann reaction is changed to any great degree by pregnancy. In a suspicious case both parents should be under observation during pregnancy with repeated Wassermann tests in the mother.

Klaften (*Zentralbl. f. Gynäk.*, 1924, 35) reports the results of his studies in the diagnosis of syphilis in parturient women by examining retroplacental blood at the time of labor. This was found to be a more delicate and certain test than the Wassermann reaction in the blood taken from a vein. Extract diluted 8 to 12 times was used; 0.4 c.c. of retroplacental blood-serum was mixed with 1 c.c. (1 to 11) with 2 per cent salt solution and the mixture was warmed. In from four to twenty-four hours the fluid became clotted and cloudy. This was produced by the increase in the colloids and the proteid bodies of the blood-serum. By this accurate chemical observation a considerable number of cases of latent syphilis were discovered which otherwise would not have been detected.

McCord (*Am. J. Obst.*, Feb., 1927) gives the results of his observations in 500 pregnant women. The Wassermann reaction was used, the first test made at the first visit, the second on admission to the hospital, and in most cases during the first stage of labor. In some the examination was made during the puerperal period.

In the 500 women the two reactions taken at the first visit and on admission to the hospital, agreed in 87 per cent of the cases. In 39 cases the reaction at the first visit was positive and that in labor was negative, and among these 31 had received treatment for syphilis; if these are deducted the reaction agreed in 93 per cent. The reaction at the first visit was negative and the one at labor positive in 26 cases. Treatment apparently failed in 35 cases in which the Wassermann remained positive. The maternal and cord Wassermann tests were positive in only 16 cases.

In cases of abortion in early pregnancy, about 10 per cent gave a positive serum reaction. It is important to note whether syphilis is present in a parturient woman before delivery, especially in recognizing accurately the cause of fetal death should the child perish during a difficult delivery. The operation may be blamed for the death, but if the mother was syphilitic during pregnancy, autopsy will frequently show that the child was syphilitic and that the real cause of infant death was syphilis in the mother; also the presence of syphilis may complicate her recovery from abdominal section.

Effect of Treatment on Congenital Syphilis.—The treatment of parturient patients by sera and such remedies as arsphenamin must not be employed without reference to the interests of the child. It is known that

the treatment of syphilis in the mother may influence the child unfavorably in some cases. That vaccines may injure the child when given to the mother is shown by Fischer (*Zentralbl. f. Gynæk.*, 1924, 40), who gave a vaccine to a pregnant woman suffering from pyelitis. On the sixth day afterward she had a severe urticaria eruption on the thighs and buttocks, the throat and tonsils were red and swollen, the cervical glands enlarged, and the throat became so swollen that it was feared tracheotomy would be necessary. The eruption spread over the whole body, spontaneous labor developed, and abundant hemorrhages were found in the body of the dead child. There was no evidence of syphilis.

He cites other cases of pyelitis where the use of vaccines was followed by fetal death.

Belding (*Am. J. Obst.*, 1926, 12:839) gives the statistics of 190 women with positive Wassermann reactions, among whom were 40 treated for syphilis during pregnancy. Clinical studies showed that a large proportion of children born of untreated syphilitic women do not develop syphilis. The question of transmission is influenced by the duration and type of the disease in the mother, and here power of resistance, and there seems to be, in some degree, a question of chance.

In active syphilis it is necessary to use treatment to prevent infection of the child. There is always the possibility of transmission in old syphilis, so every pregnant patient who is syphilitic should receive treatment. This should begin early and be continued so long as pregnancy exists. The children of syphilitic women who were not treated in pregnancy showed no evidence of early congenital syphilis in the majority of cases; 61.3 per cent had living, apparently healthy children. When the patient had no clinical signs of syphilis at the time of her pregnancy, and her syphilitic infection had occurred five years previously, the child was usually healthy.

The results in a group of women who were treated during pregnancy for syphilis are also given; 67.5 per cent of the children of these patients were born living and apparently well.

Pregnancy produces increased immunity to syphilis but it is not safe to rely absolutely upon this. If syphilis is diagnosticated in the pregnant woman, the mother should invariably receive treatment.

In the Negro.—McCord (*Am. J. Obst.*, March, 1927) has observed the results of pregnancy in 300 negro women having a four-plus Wassermann; 19 per cent of the children were stillborn, 17 children in the 300 cases died in the hospital. Abortion occurred among 10 per cent of the mothers. There was a total of 34 per cent of pregnancies which ended disastrously. The greater number of women who had stillbirths had had no antisyphilitic treatment. Of the 29 who aborted, 27 had received no treatment. The mothers of 13 out of the 17 infants dying in the hospital had received no prenatal treatment. No severe reaction followed the treatment and the writer is confident that there need be no hesitation in employing it freely. He summarizes his 300 with 300 cases previously reported, making 600 in all. He finds that 35 per cent of the births were premature in these syphilitic women and 33 per

cent were with fetal death. There was hypertension in 25 per cent of the mothers and the placenta was positive for syphilis in 43.5 per cent of 320 cases examined.

Histological study of the placenta shows the benefit of treatment.

Sixty-six of the babies who died were studied by the x-ray and in 52 per cent the characteristic lesions of syphilis were found. Section was taken from the liver and examined by the direct field method, in 68 cases. In 67 per cent of these the organism of syphilis was demonstrated. Among the mothers there were two deaths, one of puerperal septic peritonitis, the other of eclampsia and lobar pneumonia.

Pyelitis.—Pyelitis still remains a not infrequent, annoying, and sometimes dangerous complication of pregnancy. Klaften (*Zentralbl. f. Gynäk.*, 1924, 32) divides his cases into three groups: (1) Those who recovered apparently perfectly; 50 per cent of his patients were in this class. (2) The patient recovered so far as symptoms of illness were concerned but the urine remained cloudy containing leukocytes and *Bacillus coli communis* in pure culture. This condition persisted indefinitely in some cases. (3) In the third group the patient passed through pregnancy and labor and seemed to improve very rapidly, but the urine persisted in an abnormal condition indefinitely, containing colon bacilli and other germs. These patients seemed to have latent pyelitis as part of their general condition. Such patients may be called "carriers," as the urine is distinctly infectious.

This disease occurs about equally in primiparæ and multiparæ and diagnosis is sometimes difficult because the signs and symptoms, when the pyelitis is in the right kidney, resemble those of appendicitis, and cases are cited in which pyelitis very closely simulated typhoid infection. In differential diagnosis it is useful to examine the vaginal secretions where the colon bacillus is found in great numbers and various forms. They are usually absent in the upper third of the vagina and under ordinary circumstances the colon bacillus is destroyed by the normal vaginal secretion in forty-eight hours. Where, however, the vaginal secretion becomes pathological, the colon bacilli survive ten days or longer. Vaginal douches of lactic acid are often useful in these cases.

So far as the cause of the condition is concerned constipation and obstruction of the ureters are the principal factors. It is rare to find cystitis and pyelitis combined in these patients. Mild cases of this sort yield readily to treatment but severe cases are difficult to manage and dangerous. Urotropin is useful, and fatal cases result from suppurating infarcts in the kidneys. It must also be remembered that some of these cases date their pyelitis to an attack of this condition in childhood, which was very probably not detected; after severe scarlatina or measles the child may be left with a chronic condition which, so long as the general health is good, escapes observation.

The majority of obstetricians have treated these cases conservatively: Rest in bed, careful diet, urotropin, whose action is increased, it is thought, by giving dilute hydrochloric acid at the same time, vaginal douches of lactic acid, and mild purgation were the remedies most employed. Irrigation of the pelvis

of the kidney is valuable in severe cases, but without other treatment it will not relieve the severe cases. Fifty per cent of these patients make a complete recovery with judicious treatment.

Prognosis.—Naujoks (*Zentralbl. f. Gynäk.*, 1924, 47) contributed a paper upon this subject from observations made in Winter's Clinic at Königsburg. His material comprised about 100 cases occurring during twenty years in the hospital of the clinic. In these patients 21 had been thoroughly examined after their recovery from the disease, functional tests had been made of the activity of the kidneys and every effort taken to secure accurate observation. Of the 21 there were 8 who were subjectively and objectively well. They felt well, examination of the urine showed no abnormality, and the urine taken from the bladder and from the ureters also was sterile. Four patients complained of pain in the back and in the sides and other vague sensations although the urine was free from bacteria, nor was there evidence of disease in the bladder or ureters. In three of the cases a pelvic condition was found to account for the pain and the fourth suffered from dysmenorrhea. There was no evidence that these patients had not recovered from the pyelitis and their complaints indicate how difficult it is to always arrive at a correct diagnosis in these cases.

Of the 21 then, 12 could be taken as in every way well. Of these 12, 10 had had the colon bacillus, one of the proteus, and in one the exact nature of the infecting germ was uncertain. There were 9 patients examined after recovery, of whom 8 had not made a good recovery. In 7 the colon bacillus was found in the pelvis of the kidney, in one, thirteen years after the original illness, there was a mixed infection of the pelvis of the kidney and symptoms of kidney stone. There was usually chronic cystitis in these cases. One patient, twelve years after she had passed through a pregnancy and pyelitis, had a spontaneous premature labor and in a subsequent pregnancy had pernicious nausea which required interruption of pregnancy at four months and was followed by extensive purulent inflammation which caused death. There were 37 cases where pyelitis had been observed from two to thirty years previously and of these one had had a return, 23 remained in good health, 8 had not recovered from the original attack and 5 could not be traced.

It is customary in this clinic to treat pyelitis during pregnancy in a very conservative manner. In these cases catheterization of the ureter was performed 14 times, in but one only was the pelvis of the kidney irrigated, and in only one case was therapeutic abortion practiced. Reliance was placed upon rest, hygiene, warm applications, and those substances which seemed to disinfect the urine and this, the author believes, is the safer form of treatment.

Eclampsia.—*Etiology.*—Carloni and Ferrari (*Ann. di ostet.*, Jan., 1927), from 134 cases of eclampsia, found it three times more common in primiparæ than in multiparæ. Age periods 15 to 20 and 35 to 45 show the greatest number of cases. Patients having a normal menstruation had eclampsia in 1 per cent, those with genital hypofunction, 1.5 per cent, and those with hyperfunction such as profuse menstruation about 0.4 per cent. The patients who have shown well-marked functional disturbance in early pregnancy are more apt to develop eclampsia; where this has been absent, and when

eclampsia comes on, it is usually sudden without prodromal symptoms. One-fifth of these cases were postpartum eclampsia. There were no cases of eclampsia before labor.

Capillary Circulation.—Heynemann (*Zentralbl. f. Gynäk.*, Feb. 26, 1927) in five years study has found that the capillary microscope is of value in eclampsia or preëclamptic states. The capillary circulation shows, quickly and rhythmically, alterations in flow and stasis, while repeated stases are observed which may last several minutes. The latter occur after serious operative intervention.

The writer is not at all positive regarding the diagnostic value of capillary microscopic observation in eclampsia, because many of the things seen in eclampsia are also found in healthy patients. The value of the method is chiefly prognostic and provides an index of the success or failure of treatment. If capillary circulation has temporarily improved after venesection and then fails, it may be necessary to terminate the pregnancy. Where there is alternating streaming and stasis after bleeding, narcotics are indicated, and where there is prolonged stasis, tonics and stimulants.

The writer does not believe capillary conditions are the cause of eclampsia.

Triplets, Cesarean Section and Recovery of Mother and Children.—Roberts (*Brit. M. J.*, July 2, 1927) describes the case of a primipara with enormously distended abdomen, edema and unconsciousness. There was a very large percentage of albumin present, and when seen she had had several severe convulsions. The pulse was rapid, the tension very high. Temperature 102.8° F. Twins with hydramnion was the diagnosis. The fetal heart sounds were normal, the cervix closed and no indication of labor.

Section was done and anesthesia was not needed because the coma was so deep. There was considerable hydramnion and a large placenta was anterior. On opening the membranes, two good-sized female children were extracted, and a third, a male, was found in the lower uterine segment with its placenta.

The patient made a gradual recovery, regaining consciousness in about twelve to eighteen hours. There were no more convulsions. The infants did well and were nursed and partially bottle fed. Several years after delivery, mother and children were in good health.

Metabolism and Development of Eclampsia.—This is studied by Monahert (*Arch. f. Gynæk.*, 1923, 119:407). His paper is devoted largely to the question of oxidation. Carbohydrates are less oxidized in the pregnant than in the non-pregnant, so are protein substances. While as regards the fetus the absorption of oxygen is increased and the passage of carbon dioxid is less in proportion to the quantity taken. Of the nitrogeneous substances taken by the pregnant woman there is less oxidation than in the non-pregnant. As toxemia increases, so does carbon dioxid in direct ratio to the severity of the complication. Acid compounds are formed and if the kidneys become considerably affected the complication is more severe. The injection of adrenalin in pregnant patients increases metabolism but less than in the non-pregnant; there was a secondary increase followed by a decided drop in the non-pregnant. Less oxygen is absorbed and less carbon dioxid excreted after adrenalin is taken.

There is some relation between blood-pressure and oxidation in the body of the pregnant woman; there seems to be retention in the venous blood in the pregnant woman of carbon dioxid resulting from some degree of acidosis. In toxemic patients the alkalescence of the blood is often materially lessened; while this process has to do with the growth of the fetus it often indicates an abnormal condition of the mother. In 57 per cent of patients suffering from derangement in function of the thyroid, this condition could be demonstrated by chemical studies in the metabolism.

Knaus (*Arch. f. Gynæk.*, 1923, 119:450) reviews the function of the thyroid in pregnancy by calling attention to hypothyroidism with lessened secretion, accumulation of partially formed substances, high content of globulin poor in iodin, with lessened quality of cellular thyroid globulin rich in iodin. In contrast to this is hyperthyroidism having increased secretion, an accumulation of imperfectly formed material diminished in globulin and its iodin, and increase of iodin which contains globulin showing a lack of colloid material. This lack of colloid substances is invariably present when the thyroid is deranged in its action in pregnancy, although pregnancy causes the colloid to increase in quantity, its content is poor in iodin and so its function of efficiency is lessened. During the last half of pregnancy the mother stores up nitrogen which has been estimated as four times the quantity absolutely necessary for the growth of the fetus. Undoubtedly the development of the breasts is concerned in this. When myxedema and cretinism develop in pregnancy, hypothyroidism becomes extreme. When pregnancy develops in women from whom the greater part of the thyroid has been removed, a condition analogous to tetany often develops.

Treatment.—The treatment of eclampsia is the source of unending discussion and gradually material of interest is acquired from the vast accounts which this serious complication of pregnancy produces. The Stroganoff treatment remains a subject of frequent discussion.

At a meeting of the Section of Obstetrics and Gynecology of the Royal Society of Medicine, London, Stroganoff presented a paper upon this subject (*Brit. M. J.*, July 12, 1924). He alludes to the high mortality produced by eclampsia, then claims that a universal application of his method of treatment would reduce this at least one-half. His method was first employed in 1897 in 57 cases without a death. In 1918, 2208 cases treated by this method, collected from the literature, showed a maternal mortality of 9.8 per cent. In 1924, 3302 cases had been so treated with a mortality of 10.08 per cent. In his own observation and treatment, in ten years there had been 6 deaths, 2.4 per cent, and of these deaths three were from other causes. Not only was death made less common, but the patients were less severely ill and complications were greatly reduced. Psychic disturbances occurred in only 1.6 per cent; fetal mortality was reduced to 14.3 per cent.

He repeated the details of his treatment as follows: The removal of all sources of possible irritation, a darkened room, oxygen for asphyxia, careful protection during the convulsion, ⅙ Gr. morphin hypodermically injected, followed one hour later by 30 grains chloral hydrate by mouth or rectum. Two

hours later the morphin is repeated, four hours after this the chloral, 20 grains of chloral are given thirteen and twenty-one hours after the beginning of the treatment. If the child is still undelivered at the end of twenty-four hours, 14 to 20 grains of chloral should be given three times a day. If, in spite of this, convulsions occur, 400 c.c. of blood should be taken from a vein. If labor comes on, delivery of the child should be aided. The functions of the body should be promoted as far as possible. Hot bottles should be placed about the patient and warm fluids should be taken freely. The patient is kept on her right side, the mouth is carefully cleansed and oxygen is given for asphyxia. If the pulse reaches 110 or more, digitalis is administered with camphor or caffein. Bleeding was practiced in 10 per cent of cases and then only if three or more fits occurred after the treatment was commenced. If it was thought that the patient could be delivered within two hours, bleeding was not practiced.

The treatment of eclampsia is always a subject of debate. Zweifel (*Ztschr. f. Geburtsh. u. Gynäk.*, 1923, 39: 1521) reviews the literature and summarizes his clinical experience, and like others he urges the earliest possible detection and treatment of conditions threatening eclampsia. He would first of all introduce fluid into the body of such patients, and if they are unconscious in toxemia, it is injected into the bowel or subcutaneously or with the help of the stomach-tube introduced into the stomach. He would wash out the stomach thoroughly and then leave in the stomach a considerable quantity of lemon juice or very dilute vinegar and water. Eight hours after this he would thoroughly irrigate the stomach with normal salt solution and he would also use normal salt solution subcutaneously if not retained in the stomach. He would never use very large quantities lest he might encourage the development of edema.

As regards interfering with pregnancy, expectancy is the better treatment. In observing 317 eclamptic cases, there were 27 who died, 4 of these had lesions in the lung which indicated that too much fluid had been given, 3 of these patients got pneumonia because the contents of the stomach entered the bronchial tubes. Of the fatal cases, 15 showed extensive blood disintegration, 4 died of cerebral apoplexy, and there was one patient who before admission to hospital gave indication of threatened collapse.

In the very beginning of the treatment he has seen excellent results from prompt bleeding; where cerebral apoplexy is threatened, he has obtained the best results by rapid cesarean section and bleeding. In estimating the mortality, if those cases are eliminated which were favorable for treatment in the early stages had they been brought to hospital, the mortality is reduced to 3 per cent: but it must be understood that such a low mortality is not possible unless cases are recognized early and treated efficiently. The difference between indiscriminate and rapid delivery and more conservative methods is shown by fetal mortality of 36 per cent following rapid delivery, and 18.8 per cent where more conservative methods were adopted. If delivery should be practiced, abdominal cesarean section is best. He has seen for some time no cases where decapsulation of the kidneys was indicated, although previously he had seen

good results from this operation. He believes it to be important that the stomach and mouth contents, of unconscious patients, do not enter the bronchial tubes.

Stroganoff's method is always interesting in comparison with others. During a recent visit to Edinburgh he stated (*J. Obst. & Gynæc. Brit. Emp.*, 1923, 30: 1), going back to 1913 for statistics, that there were in Europe that year fourteen million confinements with a mortality in 10,000 varying from 3.5 per cent to 5.4 per cent. If the average of four mothers in each 10,000 is taken, 5600 mothers die in England every year of eclampsia and 8400 children. He estimates that 6000 children die yearly in the United States from that cause. In both countries 24,000 mothers and children are lost each year from the toxemia of gestation. New Zealand has apparently the highest mortality, 25 per cent. Stroganoff claims for his method of treatment a maternal mortality ranging from 4.7 to 23.3 per cent. He has several times reported series of cases with a mortality from 5 to 6.6 per cent. He is positive in believing that maternal mortality can be reduced to 1 or 2 per cent by his methods of treatment. He agrees with others that surgical interference is rarely indicated.

As is known, his method consists in removing all irritation, secluding the patient in a dark and quiet room, using chloral hydrate, morphin, and chloroform, and giving milk and salt solution. The patient's treatment is varied somewhat as eclampsia develops before labor, after labor, or during labor. Where the question of weakening the heart's action by chloral is discussed, he believes that from 1 to 1.5 Gm. of chloral hydrate is less depressing to the heart and centers of respiration than the eclamptic convulsion. If patients pass through eclampsia without delivery, the treatment by narcotics is continued, to prevent, if it can readily be done, the appearance of labor; but should labor develop it is assisted in the least violent manner possible. He is often obliged to use stimulation such as digitalis. The mouth and nose must be cleansed frequently and carefully, oxygen administered, pure air, and every effort made to secure successful respiration. He applies heat by hot-water bottles around the patient. If three convulsions occur he performs bleeding, taking 400 c.c. of blood. He estimates the amount of blood lost in delivery in normal cases as 800 c.c. and in view of this fact he believes that caution should be exercised in bleeding in eclampsia. The patient is disturbed as little as possible, the stomach and intestines are not molested, the patient is turned from side to side in bed frequently, remaining longer on the right side. If bleeding is practiced, dry cupping is not necessary. He quotes the statistics of Russian hospitals: 78 cases without mortality in one, 152 with 4 deaths in another, 88 cases without a bad result in another, and taking all the favorable cases, he collected 166 without mortality. Where death did occur, extensive degeneration of the viscera was found. He claims 1.07 per cent maternal mortality with fetal mortality of 5 per cent. The number of convulsions was reduced to 1.3 per cent.

Williams (*J. Am. M. Ass.*, 1927, 88) found that his mortality in treatment of actual eclampsia by immediate delivery with anesthesia, bleeding,

sweating, purgation and use of morphin and the profuse administration of fluids, was 24.89 per cent in 85 cases. He later employed a more conservative method which consisted in the use of morphia, glucose, chloral hydrates, with delivery by the least possible violence. The result was a considerable improvement in statistics, mortality of 13.3 per cent falling as low as 1 per cent in mild cases, and rising to 21.3 in severe cases.

As regards diagnosis, with the exception of the nephritic type, neither pathological study nor chemical analysis of the blood and urine give any clem to the etiology of eclampsia. Some chemical substance from an unknown site is apparently the origin.

Hochenbichler (*Zentralbl. f. Gynäk,* Feb. 19, 1927) gives the results of treatment of eclampsia in 275 cases in the hospital in Vienna. Prior to the middle of 1922, the mortality was from 15 to 20 per cent. In July, 1922, the writer began the treatment of such patients with ultraviolet rays, using the quartz lamp; 62 women had been admitted since that time in eclampsia, of whom 37 have been treated with ultraviolet rays with a mortality of 25.4 per cent. In 10 cases without mortality, the light was the only treatment, but in the remaining 27 it was combined with morphia, luminal or chloral or with venesection and intravenous or subcutaneous injections of saline or Ringer's solution. Labor was induced, forceps applied or craniotomy performed, as indicated.

In using the light, ten-minute exposure of the whole body, five minutes on each side was made, the face, breasts and genital organs alone being protected by a gauze covering. The treatment was given as soon as possible after admission, under light ether narcosis and with the lamp 1 M. distance from the patient. Further exposure with the lamp 1½ M., was given five hours after the first. This was repeated the next day, not more than two exposures being given in twenty-four hours. It was interesting to observe that the blood-pressure instantly fell after the first exposure, sometimes from 200 to 59 Mm. Hg, owing to the dilatation of the blood-vessels on the surface of the body. This greatly relieved the heart and lungs and also stimulated the general metabolism.

At a meeting of the Section of Obstetrics of the Royal Academy of Medicine in Ireland, Cassidy (*Brit. M. J.*, April 2, 1927) reported 3 cases of pernicious vomiting of pregnancy. He called attention to the necessity for distinguishing this condition from those diseases of the gastro-intestinal tract which cause vomiting, from remote diseased conditions of the spinal cord or brain, meningitis, and infection of the pelvis of the kidney. He speaks of the preëclamptic state as different from the condition producing vomiting in early pregnancy. Under the title of "pernicious vomiting of gestation" he would include only those cases where vomiting and pregnancy are synchronous, and where no cause other than pregnancy could be found to account for the vomiting. He believes that this occurs usually between the eighth and sixteenth weeks, more often in primiparæ than in multiparæ, and it has been observed that where a male child is present vomiting was more apt to occur than if the child was female.

It is evident that mental causes have much to do with some cases, and yet dogs and cats in the pregnant condition sometimes suffer from pernicious vomiting. Some authors are inclined to find the cause of this condition in a disturbance of the endocrine system or deficiency in the corpus luteum. This body is supposed by some to counteract the effect of poisons produced by the villi of the chorion. Pinard has shown that pernicious nausea of gestation happens in connection with vesicular mole as frequently as 19 in 27 cases. Others have demonstrated in these cases increase in bilirubin over the normal quantity in the blood.

Where disease or disturbance of the nervous system or excessive reflex causes the pernicious nausea of gestation, there is intense thirst, weakness and emaciation, but these conditions disappear as pregnancy advances; on the other hand, when toxemia was present, the pulse rate increased although the patient was at rest in bed. There was a dry and furred tongue; dryness of the skin; diminished quantity of urine, which contained albumin, casts and acetone; insomnia; coma, and delirium.

The 3 cases reported by the writer recovered, although each was treated in a somewhat different manner.

In discussion, Madill had tried thyroid extract in these cases without success. He had observed one case in which corpus luteum had no effect, but the patient improved when given some of her own blood by injection. Another patient had been benefited by potassium bromid. It is usually thought that if starvation through elimination and rectal enemata did not stop the vomiting, pregnancy should be ended, yet this rule is far from being a universal one.

In further discussion the importance of the mental and nervous elements was emphasized. The value of irrigation of the stomach when gently performed was reported, especially if purgatives were left in the stomach after the irrigation. Some urged that all suggestions of vomiting be removed and that the patient be given a full diet free from fat. There was considerable emphasis placed upon the opinion that most of these cases are neurotic in origin and that the results of very different treatment would indicate that this is the case. Good results have been reported by the use of insulin and glucose, indicating that acidosis had been the cause of the vomiting in these patients.

Eclampsia without Convulsions Treated by Insulin.—Thalhimer (*Am. J. Obst. & Gynec.*, 1926, 12: 369) reports the case of a patient whose previous pregnancy and labor had been normal. In the pregnancy under consideration she rapidly developed coma, high blood-sugar, acidosis, retention of non-protein nitrogen in the blood, nephritis and death of the fetus in the uterus near term. The urine showed a large sugar reaction, acetone, diacetic acid, abundant albumin, hyaline and finely granular casts.

Five per cent glucose with insulin was given intravenously, 140 units of insulin in nine hours was given on one occasion. Induction of labor was practiced by packing the cervix with gauze and delivery occurred in seven and one-half hours. Examination of the fetus and placenta failed to reveal pathological changes. After the second day following delivery, insulin was given in 20

unit doses every six hours for eight days. The patient's coma disappeared rapidly on the third day. On the ninth day after delivery the insulin was stopped.

Magnesium Sulphate.—Lazard (*Am. J. Obst.*, June, 1927) found that in therapeutic doses, magnesium sulphate intravenously does no harm to the blood nor to the liver, and in the active eclamptic patient is of use, as it seems to have a dehydrating effect upon the brain. In prophylaxis it is often useful.

After History.—This subject of particular interest was studied by Nevermann (*Arch. f. Gynæk.*, Jan. 31, 1927). He investigated the histories of 60 patients who had suffered from eclampsia, from one to twenty-three years previously. While these patients were not disabled they had inconvenient conditions traceable to the eclampsia. Thirteen had severe headache, 12 poor memory.

The writer believes that these conditions resulted from the minute hemorrhages and thrombosis found in the brain during eclampsia. Four had visual defects, 5 had swelling of the legs, 8 had high blood-pressure, 140 to 170 Mm. Hg; only 3 had albumin and cylindrical casts in the urine; of these 2 were cases of recurrent toxic eclampsia and one very slight albuminuria within one year after an eclamptic illness. In none of these patients could a transition to chronic nephritis be demonstrated.

If a patient suffering from eclampsia recovers and soon after dies of some other condition, at autopsy the kidneys will be found in an abnormal state, but this condition would have cleared up had the patient survived. In a total of 300 patients who had survived eclampsia, but 60 showed any after results.

Inflammation of the Uterine Adnexa.—While comparatively rare, this is frequently a serious condition. Patients with chronic inflammation of the tubes and ovaries are usually sterile. In other cases, however, there has been partial recovery and then pregnancy supervenes. Some of these have tubal pregnancy, others have pregnancy with more or less active inflammation of the fallopian tubes, varying in severity. These cases usually result from gonorrhea. A hematogenic infection with the pregnancy is often located in the corpus luteum and the primary focus is frequently in the tonsils or some other part of the organism abounding in bacteria. Appendicitis during pregnancy may cause infection of the adjacent fallopian tube and result in local peritonitis. From the anatomy of pregnancy, the ascending form of infection in the fallopian tube must be rare; it can develop only during the early months before the deciduous membranes have joined. These cases arise from gonorrhea and often end in abortion. Attempts at criminal abortion frequently result in a purulent salpingitis. In these cases an abscess may rupture during pregnancy and be followed by a rapidly fatal peritonitis and sepsis.

Foreign Bodies in the Pregnant Uterus.—There are abundant reports of cases in which foreign bodies have been introduced into the uterus to interrupt pregnancy and have perforated the uterus and been removed from the abdomen.

In the *British Medical Journal*, March 19, 1927, Lacey describes an interesting case of a patient aged 28 who had previously given birth to a child

with instrumental assistance, and at the time when she was seen, had been without menstruation for two months.

Her story was that she felt a lump in the vagina and had attempted to push it back with a crochet hook which disappeared. During the night following she had pain in the lower abdomen.

When brought to the hospital two days later there was a slight discharge of blood from the vagina, temperature 100.6° F., pulse 96. The cervix was closed, the uterus enlarged to about four months pregnancy. An x-ray examination revealed a foreign body, probably in the uterus, and no fetal parts. On the following day, patient aborted, temperature 101.6° F., pulse 108. Following this there developed diffuse abdominal pain with tenderness and rigidity and slight distention. The abdomen was opened and a small quantity of odorless pus was found in the abdominal cavity, the hook was protruding through the posterior wall of the uterus, firmly embedded against the sacrum. It was readily removed, drainage was inserted and the patient made an uninterrupted recovery.

In the discussion a case was reported in which the operator had removed two crochet hooks from the abdomen, one from the region of the right kidney, the other from Douglas' pouch. In neither of these cases was pregnancy present, although it was suspected.

In the experience of the reviewer, a patient presented herself at the clinic stating that she had given birth to several children and believed herself then to be pregnant. She had attempted to pass a glass female catheter into the cervix, but the catheter had disappeared. She came to the clinic because she suffered from slight abdominal pain.

On examination a foreign body resembling a catheter could be felt high up in Douglas' pouch. On abdominal section the catheter was found among the intestines above the promontory of the sacrum; the intestine was not wounded and the catheter was readily removed. The patient's pregnancy went on to term with a successful termination. It seems probable that the catheter had passed through the posterior vaginal wall at its junction with the cervix.

When an infection or injury is not severe, pregnant patients may recover without abortion. Very rarely the pregnancy causes a previous condition of inflammation in the pelvic organs to disappear. If adhesions are present in the pelvis, the result of pregnancy may be disastrous. Labor may rupture an abscess causing infection.

Schmid (*Arch. f. Gynæk.*, 1923, 120: 31) reports 4 fatal cases complicating pregnancy where foci of infection in the pelvis ruptured.

Chorionepithelioma.—There are a number of reports showing the development of primary chorionepithelioma of the broad ligament complicating pregnancy. The disease may also attack the ovary and a diagnosis cannot be positively made until tissue can be removed at operation. All patients in whom, during or immediately after the pregnancy, suspicious symptoms arise, calling attention to the possibility of this condition, should be subjected to thorough study and operation for the examination of tissues. Realizing that the condition is hopeless if pronounced, no delay should be practiced in sus-

picious cases. It must be remembered that this condition develops only after pregnancy or during pregnancy, and that it is one of the most dangerous results of pregnancy.

That chorionepithelioma of the ovary is rare, is shown by Dougal (*J. Obst. & Gynæc. Brit. Emp.*, 1924, 31 : 3), who, with his own, collected, in the literature, 11 cases.

An interesting case of primary chorionepithelioma of the ovary is reported by Dougal (*J. Obst. & Gynæc. Brit. Emp.*, 1924, 31). The patient was aged 29, in her third pregnancy, and had been in good health until she had a fainting attack and fell, injuring her head, and after being in bed she commenced to have a dark hemorrhagic discharge. For a number of years she had had pain at times in the left lower abdomen. The irregular vaginal bleeding continued about nine months, when menstruation ceased for five and one-half months. At times she had vomiting and the abdominal pain had grown worse. On entering the hospital she was thin, slightly jaundiced, normal temperature, pulse about 100. In the abdomen was a very tense tender tumor which felt like a pregnant uterus with concealed hemorrhage. On internal examination there was an elastic swelling in the pelvic cavity which pushed the uterus forward and was continuous with the abdominal tumor. At operation the uterus was extirpated and both appendages removed, and there was a large tumor in the lower abdomen pushing the uterus forward and to the right, with the omentum adhering to the upper surface of the uterus containing vessels of supply. The tumor had grown firmly into the pelvis in the left broad ligament and pushed the rectum over toward the right; the left fallopian tube and ovary could not be seen. The uterus was soft and with the right fallopian tube formed the anterior surface of the tumor. The ovary was large, cystic, and adherent. The tumor was shelled out very carefully and the uterus and tumor removed from before backward and a small dark red nodule was removed from the wall of the rectum. The patient made a good recovery, but returned a week after leaving the hospital with a recurrence of the growth as large as a small orange. This was near the rectum and high up in the pelvis on the left side. On examining the specimen removed, the tumor was a chorionepithelioma of the ovary. There were areas of hemorrhage and masses of Langhans' cells and syncytium and some portions of the tumor showed necrosis and degeneration of the villi.

With his own, the writer collected 11 cases, and also 5 where the broad ligament was the site of primary chorionepithelioma. Most of these patients were less than 31 years of age, they had had pregnancy usually one or two years before coming under observation. The symptoms were irregular bleeding for a prolonged time and after this cessation of menstruation with constant pain in the abdomen.

Of the 10 cases besides the author's, 7 were fatal and 3 recovered.

Ileus.—In some respects resembling this is ileus, complicating pregnancy. These cases are seen in constipated pregnant patients, and a diagnosis is often most readily obtained by examination with the x-ray. This shows the intestines greatly distended and may indicate a point of occlusion. The diagnosis

is made in the usual manner with operation promptly performed as the only efficient method of treating these cases.

Osteomalacia.—The question has often arisen as to whether osteomalacia is a disease congenital in the pregnant woman and only requiring pregnancy for its development, or whether it is acquired. In *Surgery, Gynecology and Obstetrics,* November, 1924, Stone reviews the literature of the subject, adding his own researches which go to show that the disease is acquired. The exact cause is at present unknown and there is no direct proof that endocrins are responsible for the disease. It is known that calcium is deficient in the blood of these patients and yet very little attention has been paid to the condition of the parathyroid in these cases. The two substances which seem to be lacking in the mother's nutrition are cod-liver oil and vitamin A.

Researches by Dragstedt call attention to the connection between the parathyroid and metabolism in pregnant animals.

Cancer of the stomach complicating pregnancy, while not a very frequent occurrence, is, like cancer at any time, exceedingly grave as a condition. Schmid (*Arch. f. Gynæk.,* 1924, Band 121, Heft 2) studied 44 cases, in 14 of which there was metastasis in the fallopian tubes. The children were lost in two-thirds of these cases and the writer could not trace a single permanent recovery in the mother. Obviously, if this condition can be recognized, immediate operation is imperative.

Experiments on animals seemed to indicate that the effort to inoculate pregnant animals with malignant growths is less successful than in the non-pregnant.

Cervix Uteri.—*Radium Treatment.*—Cancer of the neck of the uterus, complicating pregnancy, would at present naturally suggest the use of radium or x-ray in treatment. Complete recovery is reported by Couvelier (*Gynéc. et obst.,* 1924, 2) in the seventh pregnancy of a woman aged 35. This patient came into labor, was delivered by section followed by supravaginal hysterectomy, and application of radium to the cancerous cervix by the abdominal route. The child was living when delivered. With the aid of a special trocar, four tubes of radium were placed in the cervix, one in front, one behind, one on the right and one on the left, each tube containing 10 Mg. of radium element with a filter of 1 Mm. of platinum. A bag was placed in Douglas' culdesac and also in the vesico-uterine pouch. Five days later the radium was removed from the abdomen and an application made in the vagina. The bags were gradually removed and the radium changed, its application being continued in all for eleven days and two-thirds of the radium being given by the abdominal route and one-third by the vaginal route. The patient made a complete recovery.

An interesting question arises as to childbearing after radium and x-ray treatment. If this treatment is employed, what are the chances of pregnancy afterward? Pemberton reviews the literature of the subject and reports cases from Graves' Clinic in Boston (*Surg., Gynec. & Obst.,* Aug. 1924). Observation shows that the action of radium and x-ray is essentially the same. The maturing graafian follicles are more susceptible to radiation than the primordial, and radiation causes degeneration and destruction of the ovum preventing

the follicle from coming to maturity and leaving a small cyst. If the follicle is not advanced the ovum is destroyed and a single layer of granulosa cells remains. Such a dose of radium may be used that mature follicles are destroyed and the primordial follicles are not damaged. We have no information concerning the possibility of fertilization of the partially damaged ovum, whether this would result in the formation of a poorly developed child or a deformed child is not known. Women treated by irradiation have a larger percentage of abortions than those who are not treated. In cold-blooded animals radium and x-ray have produced malformations and lack of development. This has been observed in guinea-pigs and there are a few reports of similar cases in human beings.

In the Munich Clinic, Werner, in 1500 cases treated by radiation, traced 24 pregnancies with 13 well developed normal children, one premature, 9 abortions, and a hysterectomy for fibroids. Six of the pregnancies occurred in patients who had amenorrhea for several months after the treatment. All of these women showed diminished menstruation. There was one abortion to every two normal births. Others report normal children born whose mothers had been treated by radium. In one case where pregnancy was not recognized, radium was placed in the vagina for treatment and the child was small and backward in physical development when 3½ years old. A mother was x-rayed from the third to the sixth month of pregnancy on mistaken diagnosis of fibromyoma. The child was a microcephalic imbecile with atrophy and cloudiness of the lens of the eye. This same condition had been produced in animals by experiment.

Pemberton reports 4 cases of women who had been treated by radium and who afterward became pregnant. One had twins, one of whom died; the other survived and was well when 2½ years old. One had had no pregnancy before radiation but afterward gave birth to a normal child. One had eight children and after radium treatment became pregnant, with eclampsia and premature birth, the child living two days. Another was treated by radium for membranous dysmenorrhea. When pregnancy occurred she had an abortion at three months.

Reeb (*Gynécologie,* Jan. 1927) finds that further experience in the use of radium in treating cancer, should modify our views concerning the treatment of cancer of the cervix in pregnant women. If the cancer is operable and the child not viable, radium should be applied to the cervix and after a few weeks, hysterectomy with careful dissection of cancerous tissue, should be performed. When the case is operable and the fetus is viable or near viability, radium should be used and four weeks afterward cesarean section and hysterectomy performed.

Where the cancer is so far advanced that operation cannot be done no matter what the stage of pregnancy may be, a sharp spoon should be used to remove the superficial portion of the cancer, followed by the application of radium. The patient should be kept in the best possible condition until as near term as possible, when cesarean section should be done followed by subtotal hysterectomy. Radium should be applied to the cervical remnant

by the combined abdominal and vaginal route. If the results of this treatment are good and cancer grows less, the cervix may be removed.

When a physician does not see the cancerous patient until labor has developed, if the patient's condition justifies it, cesarean section should be performed and then the Wertheim operation. When the patient is very fat or in poor condition or it is doubtful whether the cancerous uterus can be removed, cesarean section should be done followed by supravaginal hysterectomy or the Porro operation. As soon as possible after this, radium should be applied by the abdomen and also the vagina, and if the tumor becomes smaller and more movable, a month later the cervix may be removed.

In Reeb's experience the Wertheim operation is more simple toward term than in the non-pregnant, for it is easier to isolate the large vessels and the ureters. It is more difficult to separate the bladder because the tissues are softer and more vascular; it is also difficult to appreciate the limits of the growth because of the general softening of the pelvic tissues.

Ramos (*Gynéc. et obst.*, Feb. 1927) has found that pregnancy makes carcinoma of the cervix more easily influenced by the gamma-rays of radium. He reports the case of a woman in her fourth pregnancy, found to have an early operable carcinoma of the cervix, at seven months. Two applications within the cervix of 0.1 Cgm. radium bromid for twenty-four hours were made. The fetus died and six weeks later labor came on. The Wertheim operation was done, followed by x-ray treatment, and twelve months later the patient was well.

He reports also a second case of a multipara with operable cancer of the cervix, admitted to hospital three days after the membranes had ruptured, with fetid lochia. A living child was delivered by cesarean section followed by Wertheim's operation and x-ray applications. A Mikulicz's drain was used at the time of operation.

Colloidal Lead Treatment.—Blair Bell (*Brit. M. J.*, April 30, 1927) showed specimen and sections of cancer of the cervix in pregnancy from a multipara twenty-two weeks pregnant when she came under observation. The uterus, tubes, ovaries and appendix were removed as completely as possible, followed by uneventful recovery. Subsequently patient received injections of lead colloid. Bell considers cancer of the cervix rare in pregnancy, occurring on an average of 1 in about 10,000 cases.

He also exhibited a primary adenocarcinoma of the fallopian tubes in a primipara aged 45. This patient had had a yellow inoffensive discharge for twelve months preceding the examination. There was frequency of micturition and the patient became very easily exhausted and the uterus was thought to be enlarged, irregular and fixed. A large swelling was felt through the anterior fornix, pressing on the bladder, and a hard mass was on either side of the uterus. The complete removal of the pelvic organs was difficult because of dense adhesions and bilateral ovarian cyst, which had burrowed deeply into the loose tissues of the pelvis. A small vesicovaginal fistula was found subsequently and easily repaired. This case was considered rare, as

primary carcinoma of the fallopian tube appears less than 150 times in the literature.

He also showed 3 cases of Krukenberg tumor, one of which was associated with pregnancy. The pregnant patient was a multipara complaining of diarrhea for two years and a painless lump in the right iliac fossa, which had increased for four months before coming under observation. She had severe pain in the right side, vomiting and diarrhea and loss of weight. On examination there was a four months pregnancy and a solid tumor to the right of the uterus extending into the Douglas' pouch, but the uterus was movable. Supravaginal hysterectomy, with removal of both tubes and ovaries, was performed. The right ovary was the size of a fetal head and adherent to the rectum, the left ovary was apparently healthy. There was a cicatricial area at the pyloric end of the stomach, and subsequently an x-ray examination showed malignant disease at the pylorus. The patient was given injections of lead, but passed from observation and the final result is unknown.

At the same society meeting, Burns described a case of carcinoma of the cervix complicating a sixteen weeks pregnancy, for which he performed Wertheim's operation and later applied radium to a return in the vaginal vault, with satisfactory result.

Fertility of Jewish Women and Prevalence of Carcinoma among Them.—Horwitz of the Mayo Clinic (*Surg., Gynec. & Obst.*, Feb. 1927) has studied Jewish patients in the Mayo Clinic, finding carcinoma of the uterus much less frequent in Jewish women than in Gentiles. The number of Jewish patients studied was 11,700. Although an accurate comparison is impossible, there can be no question of the fact that the fertility and longevity of Jewish women are greater than those of Gentile women, and that carcinoma of the uterus is considerably less frequent. On the other hand, carcinoma of the breast is common among Jewish women, almost equaling the percentage of Gentile, and carcinoma of the digestive tract is twice as frequent in the Jewish as in the Gentile.

Transmission of Tuberculosis from Mother to Infant.—Couvelaire (*Gynécologie*, Dec. 1926) has studied 126 cases of parturition in tuberculous women. Where the disease is advancing slowly it affects very little the intrauterine development of the fetus. In rapidly advancing tuberculosis, one-third of the patients gave birth to stillborn children or those dying shortly after delivery. Six of these children were examined to detect tuberculous infection and in 3 tubercle bacilli were present in the fetal lymphatic glands, although anatomically the glands did not appear to be tuberculous.

A similar result can be produced in guinea-pigs by experiment.

He concludes that there is a placental transmission of tuberculous virus with the presence of bacilli, which does not produce anatomical changes.

Tuberculous Infection of the Lung.—The interruption of pregnancy with sterilization is not infrequently practiced for severe tuberculous infection of the lung complicating pregnancy. It is not always possible, however, to obtain statistics as to the permanent results of the total removal of the uterus and adnexa in advanced tuberculosis. Misgeld reports from Bumm's Clinic

(*Zentralbl. f. Gynäk.*, 1924, 20) 56 cases. The patients selected were those who had no cavities in the lungs, were not neurotic and pregnancy not beyond the fourth month, for after the sixth month interruption or total extirpation was not thought indicated; these patients had already given birth to living children.

The results were 16 deaths, 28.2 per cent; 32 improved, 57.1 per cent; 3 were worse, 5.36 per cent; and 2 were neither better nor worse, 3.57 per cent. The operation consisted in the entire removal of the uterus and its adnexa. These cases are compared with 45 cases in which pregnancy was terminated by dilatation and curetting only. The comparison is interesting.

After total extirpation the mortality was 28.2 per cent; after curetting only, the mortality was 37.7 per cent; 57.1 per cent were improved after radical operation and none were improved where pregnancy was terminated by curetting. In 2, 3.57 per cent, the tuberculous disease was brought to a temporary cessation after the radical operation; after curetting 1.7 per cent seemed to be better. Of those who grew rapidly worse after total extirpation, there were 3, or 3.36 per cent, and after curetting, 16, or 45.5 per cent, in a series of 34 patients operated upon. Four, or 25 per cent, had severe nervous symptoms of the last 20 patients operated upon, but these symptoms were not such as to forbid recovery.

Tuberculous Infection of Kidney.—That tuberculous infection of the kidney can complicate pregnancy is illustrated by Stevens from the San Francisco Clinic (*Surg., Gynec. & Obst.*, Dec. 1924). He reports 2 cases, one aged 22, and five months pregnant, from whose neck glands had been removed when she was 10 years old. The urine showed pus-cells. The function of the right kidney was diminished; urine from the left kidney was negative. A guinea-pig inoculated with the urine from the right kidney gave a positive reaction to tuberculosis, while inoculation from the left kidney was negative. Consent to operate could not be obtained until after the confinement. The child was delivered by high forceps with a small infected wound on the left side of the neck from which tubercle bacilli were recovered. This wound healed in about three weeks, but later a gland of the same side of the neck suppurated; tubercle bacilli were abundantly present and the child died eight months later from tuberculous meningitis. The mother's kidney was removed and twenty months after the operation she was well.

The second case was aged 30, in the second month, and had a family history of tuberculosis. Tuberculous infection of the bladder was proved by inoculation, and infection of the right kidney. The patient was operated upon followed by marked improvement and abortion two months after the operation. Four months after the operation the remaining kidney was found to be tuberculous.

Stevens reviews 35 reported cases of nephrectomy during pregnancy for conditions other than tuberculosis. The purpose of this review seems to be to determine the possibility of the continuation of pregnancy after this operation. In 26 cases the patient went to term, labor was induced in 2, abortion occurred in 6, mother and child died in one. In the 17 patients who went to

term, the child was normal. In addition to the 2 reported cases, the writer found 16 cases of nephrectomy in pregnancy for tuberculosis of the kidney; 12 had nephrectomy with recovery of all the mothers; in 6 a normal child was born at term; abortion occurred in 3, and in one of them, two months after the operation; one patient had a dead child at seven months, four and a half months after operation; the death was not due to the operation. The operation was done in all of the months of pregnancy up to and including the sixth. In 5 pregnant patients having renal tuberculosis who were not operated upon, 3 became much worse; death occurred in the eighth month in one. In 4 cases who were not operated on there were two abortions, one child infected at birth subsequently dying, one normal child at term. Obviously all pregnant patients suffering from unilateral renal tuberculosis should be operated on as soon as the diagnosis can be made. The children born of tuberculous mothers have an average mortality of 58.8 per cent. Following the operation tuberculin should be given, the urine examined often, and the patient kept under observation. If after two or three years the remaining kidney is free from tuberculosis and the woman is in good general health, pregnancy is permissible.

In 261 cases of pregnancy occurring in women from whom one kidney had been removed, there were 250 normal and 15 complicated labors with but 2 deaths. Should bilateral involvement be present, tuberculin should be given with good hygienic treatment and little will be accomplished for the mother by sacrificing the child.

In the observation of the reviewer, a woman from whom one kidney had been removed for tuberculosis, passed successfully through eclampsia and although her child was stillborn she made a good recovery. She was treated by medicinal and obstetric measures only, without operation.

Treatment in General of Complications.—A review in general of the treatment of complications of pregnancy is contributed by Aschner (*Arch. f. Gynæk.*, 1923, Band 120, Heft 96). He calls attention to the frequent occurrence of interstitial hemorrhage in the nervous system, the ear, respiratory tract, the digestive tract, kidneys, heart, blood-vessels, bones, joints, and skin. He also states that during pregnancy septic inflammation, catarrhal inflammation, and exudate are observed. Patients frequently complain of the first symptoms of a developing inflammation such as congestion, disturbance of sensation of the hands and feet, heaviness in the limbs, aching pain about the head and teeth, neuralgia, catarrh, hyperacidity, and constipation. Many suppose that these occur inevitably in all pregnancies and pay no attention to them. They are, however, important and are usually controlled by rest, carefully regulated diet, and the giving of alkalies.

The writer ascribes these symptoms to the influence of the fetus and decidua on maternal blood. Toxins are produced, some of which may be used in fetal growth but most of which are distinctly harmful. These symptoms are important as indicating the first stage of toxemia because at that stage patients yield readily to treatment.

There is also a tendency in all pregnant women to thrombosis, embolism, and their results, and to failure in the normal action of the heart with con-

gestion in various organs, notably the kidneys, and in severe cases the development of eclampsia.

Unquestionably the ancient belief that pregnant patients would be benefited by losing blood, has some foundation in truth. Because of her plethoric condition the pregnant woman is more liable to infection, and when this occurs, it readily becomes severe. In the treatment of this condition elimination is of primary importance. Nothing compares in value with this method of treatment. That the condition is widespread and profound is shown by recent microscopic studies which demonstrate the fact that the capillaries are involved and that in blood-making organs this capillary involvement readily predisposes to disease.

In women of very dark complexion with a tendency to sluggish action of the liver, and abnormal condition of the blood, one sometimes observes the death of the child at a normal termination of pregnancy, although the mother may be free from syphilis. In some cases she is very syphilitic. When no other cause can be found the death of the child must be due to a disturbance or failure in internal secretion in either the mother or the child. A considerable number of these mothers show hyperthyroidism and the greater number of children are males. To prevent such loss the fetal heart sounds should be watched, especially during labor and if they show signs of failure the child must be promptly delivered.

While an effort has been made to demonstrate a distinct pathological relation between the blood of the mother and child, this effort has so far not been successful.

The study of the blood in pregnant women is interesting and in 200 patients, in 44 primiparæ the average leukocyte count was 11,480; while in multiparæ it was 9,490. During the last months of pregnancy digestion influences the condition of the blood in a third of the cases. This was especially true where either proteid or carbohydrate foods were freely used, but these gave no evidence of insufficient action of the liver. In proportion as the patient had better care the blood-cells showed less variation and better development but if the pregnant patient was without proper conditions of living, degenerative forms were seen in the blood-cells.

The familiar fact that during pregnancy the excretion of urea is lessened and ammonia coefficient is increased, seems to indicate that the process of producing urea is carried on more extensively than in the non-pregnant. The test of liver function is made by giving the patient, by mouth, organic compounds of ammonia and afterward subjecting the urine to examination. In patients whose livers are healthy, in twenty-four hours following this administration, the urinary salts are quantitatively increased when compared with the urea. If this experiment is to be accurate the diet of the patient must be regulated and the patient must be under observation and care for several days preceding the test. In the writer's experience from 20 to 40 Gr. of ammonia citrate were administered and the urine examined and in healthy patients there was no result observed. In others there was a trace of albumin and acid compounds in the urine. In the last months of gestation it was sometimes

interesting to give a patient a very rich protein diet and restrict the carbohydrates. Under these circumstances the carbohydrate intake of 120 to 150 Gm. daily, seemed to be sufficient to prevent disturbance in the patient's health.

The feces of the patients in these observations showed no excessive quantity of protein in the matter discharged. These and similar observations go to show that the use of protein food alone in pregnancy, is not a serious factor in producing toxemia.

The Weight of the Parturient Patient during Pregnancy and Labor and the Puerperal State.—Kemper (*Arch. f. Gynœk.*, 1924, Band 121, Heft 2) finds that four factors influence the weight of parturient women, the initial weight of the woman, the number of pregnancies, age, and the intensity or average rate at which variation in weight develops. When cases are studied in groups and compared, it is found that there is less variation in weight in parturient women during pregnancy and the puerperal state than has been supposed. Even twin pregnancy produces surprisingly little variation.

Antenatal Care.—In discussing the care of pregnant women, the question of the success of so-called antenatal clinics, and the application of their methods to private practice, becomes of definite interest.

At a meeting of the British Medical Association at Bradford in 1924, a discussion occurred on this subject, Fairbarn presiding (*Brit. M. J.*, Aug. 16, 1924). Willitt, of the City of London Maternity Hospital, stated that their antenatal work began in 1908. They have had no difficulty in examining all primigravidæ and all multiparous patients who had a history of previous complications. Patients are warned at once if any symptom develops, urine is examined each month and the breasts and nipples receive careful attention. When the vomiting of pregnancy is not severe, attention to diet, excretion, and the free use of fruits and the assurance that the patient will improve and recover, are all that is required. Abortion is believed to occur in from 20 to 25 per cent of all pregnancies and there will be no improvement in this percentage until patients place themselves under medical care as soon as pregnancy is known, and also until hemorrhage from the vagina is regarded as a sign of great danger and a symptom to be reported at once.

It is usually possible to detect and treat syphilis in pregnancy satisfactorily. If gonorrhea is discovered the patient is referred for treatment to the department for venereal diseases in a general hospital. In tuberculous patients, the management depends upon the social status of the patient and her resources. Cardiac cases, if severe, must enter hospital. In 2145 patients, 204, about 10 per cent, required especial investigation or treatment; 57 had albuminuria but there was no eclampsia although it was feared that many of these cases had chronic nephritis. There was but one case of pyelitis in 104 patients, but wherever there was any symptom of irritation in the region of the kidneys the citrates were freely prescribed. One shoulder presentation and two face presentations were not recognized before labor; the mothers were multiparæ and had normal pelves. Most of these patients were first seen about the twenty-eighth week and breech presentation was not uncommon; in many of these cases the vertex subsequently presented by spontaneous version. It is

hoped that the x-ray may give much assistance in recognizing these cases. Where breech presentation is detected, external version is practiced and to dislodge the presenting part, the foot of the patient's bed is raised. Disproportion between mother and child occurred in about 1 per cent; if the occiput was posterior and deeply engaged, there was no interference. If the head was high up with occiput posterior, manual rotation was tried and late in pregnancy pads and a binder were useful.

The writer's method of pelvimetry was simple and to many satisfactory. He applies the tip of one index finger on the anterior superior spine of the ilium and the tip of the other on the highest point of the crest, between these two points the distance should be not less than 2½ inches which can easily be measured by the eye. The skin is then stretched along the outward edge of the iliac crest and if the patient is lying on her back the normal curve has the convexity downward and backward; if the pelvis is abnormal these conditions are wanting. If there is a suspicion of abnormality the pelvimeter should be used in addition. If one has no pelvimeter the length of the hand from thumb to little finger outstretched, may be used. He finds it important to recognize the landmarks of the fetal head, especially the parietal eminences. If the situation of these landmarks indicates disproportion, if recognized early, they may be an indication for early cesarean section. He believes that the head will mold one half inch without injury. To estimate this the most important guide is the anteroposterior thickness of the pubis. If the pubis is thick and the parietal bone overrides or overhangs the pubis the indication for delivery by section is positive. Examination is made as much as possible by the abdomen, but when difficulty is anticipated, vaginal palpation of the head while pressure is made from above, is of great value. Labor was induced in 24 of 204 patients, in 4 at full term, in 19 after thirty-six weeks. There was no maternal mortality, one child was stillborn, and one was delivered by forceps. In 13 cesarean sections the mothers all recovered. In 16 cases going over term, labor was induced without maternal or fetal death. The histories were often obscure among these patients, but in estimating prolonged pregnancy, the rule was made to compute three hundred days after the last period. Other signs were also taken into consideration.

Hemorrhage developing during pregnancy was observed in but 3 cases and such patients must be treated in hospitals only.

These and other similar reports indicate that the principles of prenatal care may be transferred from clinics to private practice with great benefit.

The influence of work on the pregnant woman is of interest not only for general consideration concerning the success of pregnancy, but also with regard to the possible development of the toxemia of pregnancy. Carlinir (*Rev. franç. d'obst.*, 1923, 19) reviews extensively the literature upon the subject. There is no question that rest for the mother in the last weeks of pregnancy secures a better condition for her and the better development of the child. This rest does not exclude moderate and healthy exercise.

In contrast to this is the effect produced by painful and excessive work, especially if carried on under unfavorable hygienic conditions. Women work-

ing in shops, factories, and arsenals are naturally under more unfavorable conditions than those working in the country, their nutrition is worse and so is that of the offspring. Many pregnant women cannot work in tobacco factories without suffering. Painful and excessive work in a mother, especially if done in an uncomfortable and cramped posture, may shorten pregnancy, bringing the patient into premature labor. Unquestionably abortion is more common among women engaged in work than among those who are not, but this is not so much the result of the fact that these women work, as depending upon the circumstances that make them work under unfavorable conditions and injuriously.

Value of Antenatal Care.—Ganuneltoft (*Acta Obst. et Gynec. Scand.*, 1926) gives the statistics of the lying-in department of a Copenhagen hospital where 14,633 confinements occurred. There were 121 deaths, of whom 29 were due to intercurrent diseases In 39 of the 121 fatal cases, treatment during pregnancy might have saved the patients.

In Denmark there are antenatal clinics and a Mothers' Help Society, partly supported by the state, which gives valuable care to pregnant women.

Antenatal Prevention of Difficult Labors.—Kynoch (*Brit. M. J.*, June 4, 1927) states that the duty of the obstetrician in early pregnancy is to preserve the pregnancy and in the last three months to anticipate the complications of labor. Antenatal supervision must begin early. In malposition, a transverse position can be corrected by external version up to the very commencement of labor; in breech presentation in primiparæ, external version should be attempted, but not until the last week or two, for if done earlier, the fetus is apt to return to its old position. In occipitoposterior positions he advises the use of pads and binders. Pelvimetry in pregnancy is of great importance, and especially the failure of the head to enter the brim in the last weeks of pregnancy in primiparous patients is always a significant warning.

An x-ray examination is often of value to reveal abnormal position and multiple pregnancy; it also reveals some of the rare varieties of pelvic contraction.

The writer believes that the excessive indulgence in athletics by women, might favor the production of a male type of pelvis which would render labor difficult.

Pregnancy after Tubo-Uterine Implantation.—Cotte and Bertrand (*Gynéc. et obst.*, March, 1927) have investigated the results as to the occurrence of pregnancy after tubo-uterine implantation. The authors report 3 cases published in France. The permeability of the tubes and the anastomosis was shown by radiographic examination after the intra-uterine injection of lipiodol, five months after operation in one case and fifteen days in two others. In 12 other cases taken from the literature, permeability was demonstrated in 3 by Rubin's insufflation method. Of the 15 cases alluded to, 13 have been operated on within the last four years, 6 pregnancies have followed, 2 are known to have resulted in the birth of living children.

Treatment of Sterility in Women.—Polak (*Surg., Gynec. & Obst.*, April, 1927) after a review of the causes which may impair fertility and pro-

duce sterility, concludes that in each particular case, treatment must be individual and the procedure decided upon only by a careful and repeated study of the potential possibility of husband and wife. About 30 per cent of cases of sterility are due to disease of the male. When this is not present, the anatomical condition of the genital tract of the woman should be ascertained and such operation performed as may be necessary.

The condition of secretions in the cervix should receive attention. Endocervicitis, in his observation, has been directly or indirectly responsible for female sterility in 70 per cent of cases. While amputation of the cervix or posterior discission may be necessary if endocervicitis of any type or origin is present, the use of a stem-pessary is absolutely contra-indicated.

Repair of the pelvic floor may be helpful. Myomata of the uterus may be removed, angulation of the tubes corrected by plastic operations, and salpingostomy is successful in about 70 per cent of cases. Resection of the tube with implantation is more successful. Decapsulation of the ovary may be necessary. In bilateral hydrosalpinx or severe chronic salpingitis, there is practically no help from operation. Diet, exercise, sunlight and the hypodermic use of endocrins are especially successful in the hypothyroid type with low basal metabolism.

Birth-Control.—This subject, which excites continuous discussion from various sources, has been made the subject of a book entitled *Medical Views on Birth Control,* edited by Sir James Marchant, and published in London. It is a symposium or collection of essays upon the subject. It is in a conversational style and addressed to the public. The essays number ten. The compiler is secretary of the National Birth Rate Commission.

The contributors to the volume are obstetricians and students of sociology in England. Their arguments may be briefly summed up that in a considerable number of cases, well-defined medical indications exist for the prevention or control of conception, but that these cases should be dealt with on their merits in the consulting room of the doctor, with the assent of the patient. The essayists consider it extremely doubtful whether birth-control should be more generally practiced on any grounds. They found that most of the alleged reasons, if critically examined, are based on fallacies or imperfect knowledge of facts, and such reasons ignore the injurious effects which birth-control may produce. Without birth-control there are natural limitations to the increase of the population arising from the reduction in the birth rate and the natural limit to fertility. It is estimated that with a lower birth rate the population of the British Islands may become stationary and decrease within twenty years.

Real evidence does not exist of threatened overpopulation, nor that where a considerable number of children exist in a family, that the children are unhealthy or ill developed. So far as the argument is concerned of unfitness, with the exception of a small proportion of mentally deficient persons, this cannot be determined. There are arguments in favor of a reasonably large family, nor is it found that the mother suffers from the production of a number of children. From the standpoint of morality and health of mind and body,

the essayists believe that natural relations and processes should not be interfered with. It is furthermore observed that not one of the prescribed methods of birth-control is infallible.

Induction of Labor.—*Ovarian Extract.*—Addis (*Brit. M. J.*, Feb. 26, 1927), in 22 cases varying from thirty-six weeks to a week beyond term, had induced labor by injecting 1 c.c. of ovarian extract into the pectoralis major muscle of the patient, where it formed the anterior border of the axilla. He did not use corpus luteum. The contractions of the uterus at the beginning of labor were painless, so that the case was studied by palpation. The first dose was usually effective for about three hours, when a second was required and in each 1 ounce of castor oil was given by the mouth. A partial failure occurred in the first case in which the method was tried, the others were completely successful.

It was interesting to note that the labor thus induced was practically painless through the first and beginning of the second stage. In most of these patients pain did not really develop until the presenting part came upon the perineum.

Quinin Causing Fetal Death.—This important question is considered by Gellhorn (*Am. J. Obst.*, June, 1927). He draws attention to the popularity at present of the induction of labor by castor oil and quinin and the belief that it is harmless. In his case the usual dose of quinin was followed by intrauterine death of the child, which was expelled in a macerated condition, seventeen days after castor oil and quinin had been given to induce labor. A thorough examination of the mother, child and placenta found no other cause for the fetal death.

The child died so promptly after the quinin was given that the conclusion is inevitable that there was a relationship between the two. The writer has collected two analogous cases.

His patient had been delivered by cesarean section for placenta prævia, and three years afterward had a normal pregnancy. The child was large and the induction of labor was advised to avoid strain upon the uterine scar. Accordingly the patient took four tablespoonsful of castor oil and three doses of 10 Gr. each of quinin, 30 Gr. in all. There were no uterine contractions but the patient felt some ringing in the ears. The child was a little more lively at first, but later all fetal movements ceased and at no time during the following two and a half weeks could the patient feel any motion, nor could heart sounds be heard. Fifteen days after the supposed death of the fetus there was a very dark discharge, with a few cramps. A small bag was inserted through the closed cervix when labor came on with the delivery of the child.

Overgrown Fetus.—Adler (*Zentralbl. f. Gynäk.*, April 23, 1927) states that a fetus is almost invariably lost in spontaneous labor, if pregnancy exceeds 302 days. As the weight of the infant increases, so does the necessity for operative delivery, and the mortality of the infants increases in like ratio.

So far as the induction of labor is concerned, the writer uses castor oil given by mouth and pituitary extract by injection. This method is entirely useless unless the patient is at term.

In 100 cases this method was successful in 61, uterine pains beginning in about two hours.

Castor Oil, Quinin and Pituitary Extract.—This subject, in which Watson has made valuable and prolonged study, is treated by Mathieu (*Am. J. Obst.*, Feb. 1927). His cases number 91; 52 primiparæ and 39 multiparæ. There were 3 failures, 3.3 per cent; in one the child was large and the head could not be fitted into the pelvis. Forty-eight hours after the treatment was stopped, a normal delivery occurred. In the second case a large head did not descend and a second attempt at induction was made, followed by successful delivery with low forceps. The third case was one of severe bilateral colon bacillus infection of the pelvis of the kidney. Induction was prohibited until the child was viable. The treatment prescribed failed twice and then the introduction of bags was successful. The patient was ill during her postpartum period.

In 4 cases the patient's temperature rose to 100.4° F. on two different days: One had chronic nephritis and severe toxemia, one pyelitis, one non-suppurative mastitis and one a contracted pelvis for which cesarean section was done with considerable shock. The colon bacillus was found in the urine and the patient recovered under treatment. There was no morbidity among the children which could be traced to the induction or type of delivery, and there were no maternal or fetal deaths.

Sixty-two inductions were successful in the first trial, 20 in the second and 6 in the third. The dose of pituitary extract was 3 Mm. and with this blood-pressure was not raised more than 5 points. In the hospital the patient is given castor oil, 2 ounces, and quinin sulphate 10 Gr. and hot soapsuds enema two hours afterward, at the end of which 3 Mm. of pituitary extract are given by hypodermic injection. The pituitary dose is repeated in this way every thirty minutes until labor starts; it is then stopped. If eight hours pass without labor developing or if there is no sign of any effect, or the mother cannot endure the frequent hypodermics, the method is abandoned, the mother is given a sedative or hypnotic and twenty-four or forty-eight hours after another attempt is made. In only 8 cases were more than twelve hypodermic injections of pituitary extract given. In some cases labor started, but uterine contractions completely ceased; with these patients the injections of pituitary extract were again used in the routine manner.

The membranes ruptured early in 8 of these cases, but this seemed to have no bad effect. The longest labor was eight and one-half hours in a primipara, the shortest in a multipara, one hour. There were two cesarean sections in primiparæ, operation done after the test of labor. Labor was normal in 33, forceps in 51, version in 5, cesarean section in 2. There were 91 vertex presentations, one converted from the breech and one breech presentation.

It is interesting to note the frequency of forceps deliveries in this series.

Interruption of Pregnancy.—A group of papers upon this subject by Eden (*Brit. M. J.*, 1926, 2:237), McIlroy (*ibid.*, 240), Barris (*ibid.*, 241), Price (*ibid.*, 242), Cole (*ibid.*, 244), and Evers (*ibid.*, 245) present different views upon this subject.

Eden states that no strict rule can be given for the interruption of preg-

nancy. Continual progress in the prevention and the treatment of disease would require constant change and revision in these rules.

At present pregnancy must be considered a definite risk to a tuberculous mother from the standpoint of the community; the birth of a child with the chance of tuberculosis seven times that of other children can scarcely be desirable. Chronic nephritis always renders pregnancy dangerous. In addition to local damage to the kidney, toxemia and accidental hemorrhage in the uterus are important. The fetal mortality rate is 40 per cent. A patient with chronic nephritis in her first pregnancy may try to go on under careful supervision. If the first pregnancy fails, succeeding pregnancies should be interrupted. In any patient with chronic nephritis, becoming pregnant, the presence of albumin and edema justify interruption. Infection of the urinary tract with the *Bacillus coli communis* rarely justifies the interruption of pregnancy. The use of insulin has greatly lessened the risk of diabetes. Glycosuria alone is not dangerous.

A young patient with good compensation, although having a valvular heart lesion, may pass through several pregnancies successfully, although the quick repetition of pregnancy results in cardiac damage and shortens the patient's life. Should the cardiac muscle give signs of failure, pregnancy must end.

If study by experts decides that the pregnant patient has had puerperal insanity or had a bad heredity or was a case of marked nervous and mental instability, interruption of pregnancy might be justifiable. In chorea, the development of high fever would indicate the termination of pregnancy.

Among London physicians the interruption of pregnancy for toxemic vomiting is said to be extremely rare. Where the presence of vesicular mole can be diagnosticated, abortion may be produced, but such diagnosis is often impossible until after considerable hemorrhage and partial or complete dilatation of the cervix. When the uterus grows smaller in size and fetal death is diagnosticated, administration of quinin and castor oil will usually cause the expulsion of the dead fetus.

So far as hemorrhage complicating pregnancy is concerned, it is more important to observe that the bleeding persists, than that the bleeding at any time is considerable.

McIlroy urges the importance of consultation in deciding upon the interruption of pregnancy. The slow method of dilatation by tents, or dilatation with Hegar's dilators followed by a packing of gauze saturated with glycerin, are favorite methods. Only in very early pregnancy can the uterus be rapidly emptied under anesthesia.

This is emphasized by Barris, who states that before the end of the third month the rapid method is readily applied. After the third month, the cervix having been dilated, he would practice section through the lower uterine segment, through the vagina, penetrating the membranes and removing the fetus by traction upon the leg. If the slower method is indicated after the third month, the dilating bag is especially good. Where vesicular mole is present, abdominal cesarean section gives success.

Price drew attention to the fact that in cardiac cases, the condition of the heart muscle is an important element. Where cardiac failure is slight, the patient can probably go to full term without risk of life. If more severe during the first half of pregnancy, the chance of going to term is less. If this occurs in the second half of pregnancy, the patient can probably go to term, but in either case there must be absolute rest for a considerable time. Cases of severe heart failure in early pregnancy sometimes do surprisingly well with rest, so that when this occurs in the second half, every effort should be made to carry the patient to term. Should cardiac failure become extreme at any time in pregnancy, interruption is indicated.

Cole had found that insanity during pregnancy comprises less than 1 per cent of the total percentage of insanity in women; while mild disturbances are common, they rarely become severe. When insanity develops late in pregnancy, it continues after delivery. He had never seen a case where interference with pregnancy was justifiable, because of mental disturbance traceable to worry in pregnant unmarried women. Occasionally patients with marked obsessions and morbid fear of death may be so depressed that the interruption of pregnancy may be indicated. In his experience he has not seen cases where insanity had previously developed, or border-line cases with bad family history, where he felt justified in interrupting the pregnancy before the child was viable. When the patient has become pregnant by an insane man and is obsessed with the fear that the child may be defective, if the obsession cannot otherwise be relieved, pregnancy may be interrupted. Among pregnant women, dementia præcox and the depressive types are most common. If exhaustion be threatened in the early months of pregnancy, interruption would be of no benefit.

Evers urged against the interruption of pregnancy. He stated that the importance of embryonal and fetal life has greatly increased. The management of most of the conditions threatening mother and child has enormously improved. Careful analysis shows that many of the dangers which we consider inevitable in pregnancy rarely exist.

Interruption of Pregnancy in the Rat by Injection of Ovarian Follicular Extract.—Smith (*Johns Hopkins Hosp. Bull.*, 39: 203), by experiment, has shown that it is possible to interrupt pregnancy in the rat in the first five days of pregnancy by injecting follicular ovarian extract; as the pregnancy advances the amount required increases.

From this observation he is inclined to believe that between the function of the follicular secretion of the ovaries and the corpus luteum, a considerable difference exists.

Interference with Pregnancy and Sterilization.—The effort to make public knowledge concerning birth-control is increasing interest in the question of sterilization by surgical means. Freund (*Zentralbl. f. Gynäk.*, 1923, 42) operates by severing the fallopian tube and burying one of the severed ends in the peritoneum and stitching the other end to the abdominal wall. A firm silk ligature is placed around the tube at its junction with the uterus. In 70 cases conception has not followed after the operation and very little shock or disturbance was caused by this procedure.

The effort to secure temporary sterilization is believed by the majority to be impracticable. If the fallopian tube is severed the epithelia degenerate and the natural function of the tube cannot be accomplished. Very often these operations are accompanied by the shortening of the round ligament.

It is possible also to perform this operation, interrupting early pregnancy by the extraperitoneal vaginal cesarean section. Heinsius opens the anterior vaginal wall longitudinally above the cervix, pushes back the peritoneum and without opening it, incises the uterus at the internal os and through the lower segment. Should it be necessary, the peritoneal sac can be opened and, at the termination of the operation, closed by suture.

Sterilization is not effected by this procedure but early pregnancy can be interrupted with comparatively small disturbance to the patient.

Injury of Fetus by X-Ray.—Flaskamp (*Zentralbl. c. Gynäk.*, Jan. 1, 1927) has used the x-ray upon the ovaries to produce arrest of ovarian function, sometimes called temporary sterilization.

The dose given is strong enough to produce amenorrhea and sterility for some time. In a second method of treatment called weak ovarian reduction, there is no amenorrhea, the function of the ovary is not arrested, but ripe ova may be damaged by the x-ray, and as conception during this time is possible, the result may be the development of a damaged fetus. The writer very strongly advises against weak reduction, although it is often advised for inflammatory conditions and for sterility.

There is difference of opinion concerning temporary sterilization. The first conception which follows the amenorrhea often ends in abortion. This may be the result of the condition for which the x-ray was used, and abortion is especially likely to happen if conception follows almost immediately on the amenorrhea. Pregnancy subsequently is usually normal. After the temporary amenorrhea children then conceived and born, in 200 pregnancies, were healthy and not damaged by treatment. This indicates that the ovary completely regains its function after the amenorrhea.

The technic of temporary sterilization is difficult and only an expert should undertake it. It is successful in carefully selected cases of severe inflammation of the tubes and ovaries where recovery is retarded by menstruation, but it should not be used to prevent conception or as a general measure. In the period between radiation and the development of amenorrhea, conception should be avoided, and should it occur, the pregnancy should be terminated because the ovum is invariably damaged.

DeNobele and Lams (*Brit. J. Radiol,*, No. 31, 1926) report their study of the effect of the x-ray upon pregnant guinea-pigs and rats.

Where the ordinary erythema dose was given the embryo was usually killed. The earlier in pregnancy the more sure was the death of the embryo. If in the beginning of the irradiation the embryo was not killed, its later development was abnormal. There were no abortions but the evolution of the pregnancy was stopped and the embryo was absorbed.

In the later part of pregnancy, abortion would probably have been caused. In guinea-pigs the rays seemed to produce ovarian cysts. The embryos that

were carried to term showed lesions of the nerves and sensory centers, such as hydrocephalus and microphthalmus.

Abortion.—Rock (*Boston M. & S. J.*, 1926, 195:843) believes that most spontaneous abortions are caused in man and the lower animals by disturbances in the fertilized ovum or maternal organism, and not by accidents from without which happen to the mother. He believes that the causes of sterility and of abortion are largely the same. The two conditions must be regarded as different degrees of diminished fertility. To arrive at a correct diagnosis, the causes of abortion should be studied in detail with a careful examination of the product of conception and also of both father and mother.

It is usually easy to make a diagnosis of abortion; it may be hard, however, to distinguish between a threatened and inevitable abortion. The treatment of threatened abortion should be to prevent it if possible; later if it is seen that the abortion is inevitable and incomplete, it must be made complete.

In 131 cases at the Boston Lying-In Hospital, the conservative treatment was followed where cases were doing well by themselves, interference was practiced as rarely as possible. In septic cases of abortion the uterus should not be invaded unless active and severe hemorrhage developed.

Management.—The management of abortion is always a subject of prolific discussion. In the *Journal of the American Medical Association* for March 29, 1924, Gordon states the results of his treatment of 1640 cases, of whom 961 were minutely studied. These were naturally divided into infected and non-infected, and those were called infected having a temperature above 101° F. by rectum or where there had been interference with the uterus. There were 1528 cases where the abortion was incomplete.

In treatment, on admission the patient was prepared as for labor without interference with the vagina, one vaginal examination only was made. The patient was put to rest in bed and given morphin to quiet suffering, and daily a low enema. Hemorrhage called for active treatment which consisted in removing the products of conception which were in the cervix and partly expelled, by the stick-sponge method. The vagina was thoroughly packed with antiseptic gauze and this manipulation was usually practiced through a speculum. Packing was necessary in 62 per cent of cases, of whom 53 were packed once and 10 per cent again. In 38 per cent no packing was required. If the symptoms indicated that abortion was inevitable, 0.5 c.c. of pituitrin was given by hypodermic every three hours for four or more doses. Whether the abortion is complete or not cannot be definitely ascertained without observation extending from five to seven days. The packing introduced is removed in eighteen to twenty-four hours and repeated in 10 per cent of the cases. Septic cases should never receive active treatment. If the patient's temperature is more than 101° F. by rectum, no intra-uterine manipulation is permissible. In most septic cases hemorrhage is rare. These patients were placed out of doors if possible in the Fowler position and feeding was forced, repeated transfusion of small quantities only of blood seemed to help some. Those who were syphilitic received arsphenamin and some had vaccines, sera, foreign protein, and neutroflavin. Careful observation could find no difference

in the ultimate results or duration of the illness under any one type of treatment. Conservative treatment properly carried out will fail in less than 4 per cent of cases and mortality and morbidity are in direct ratio with the degree and frequency of uterine invasion. The use of the curet makes septic many originally clean cases. In the 1640 cases, 18 died, 12 of sepsis in whom the curet had been used before admission, and 3 had had abortion induced. One hundred ninety-three patients had sepsis, of whom 181 recovered. In the 1640 the curet was used 39 times.

That *fever complicating abortion* is of importance is shown by Winters (*Zentralbl. f. Gynäk.*, 1923, 38) by his bacteriological study in the first twelve hours after abortion; in streptococcus infection the mortality was 15.5 per cent, staphylococcus 8 per cent, *Bacillus coli communis* 3.1 per cent, hemolytic streptococci 20.8 per cent. In general septic infection the mortality was 100 per cent, where pyemia was present 60.6 per cent, diffuse peritonitis 64 per cent. Where there was pelvic peritonitis and pelvic abscess there was no direct mortality, nor was there mortality where the tubes and ovaries were involved or where there was exudate in the pelvis. Under hospital treatment these cases did well. In the attempt to remove the remnants of the ovum, much depended upon the character of the infection present. When hemolytic streptococci were found, the mortality was 30 per cent; where the streptococci were not hemolytic, 16.4 per cent, and 64.5 per cent of cases of abortion emptied the uterus spontaneously. Drugs had little effect in producing this result. In 792 cases without infection, the mortality was 1.1 per cent. The mortality of interference depends largely upon the local conditions present; in general sepsis, 100 per cent mortality results, this is also true in pyemia. When peritonitis is present the mortality following interference is 88 per cent, and where there is inflammation of the tubes and ovaries 25 per cent and there seems to be little difference in the use of the finger and blunt curet, the finger having 3 per cent mortality, the curet 2.6 per cent. Four or five days should pass with comparatively low fever before interference is practiced and bacteriological study should be made of all cases if possible.

In the *Journal of the Medical Association of South Africa,* January 22, 1927, Maxwell states that it is his habit, in cases of incomplete abortion, without fever, to evacuate the uterus as early as possible. He believes this to be a simpler and safe method, avoiding the risk of hemorrhage and infection. He has seen serious damage following the use of Hegar's dilator and so prefers the laminaria tent. If these are kept indefinitely in absolute alcohol, they are aseptic and ready for use, and their advantage is that they produce a uniform, constant and slow dilatation without danger of laceration. This method is most successful in cases at about the fourth month, and it is of great advantage to be able to explore the uterus with the finger. If a piece of placenta is so firmly adherent that the finger will not remove it, a curet must be employed. Where there is fever with sapremia or sepsis, the uterus should be emptied under an anesthetic, when rapid improvement usually follows. If in the abortion there has been injury to the wall of the uterus, the cervix, or the fornices of the vagina, and septic infection has developed, the writer advises dilatation

and thorough exploration with the finger, removing septic material and giving very gently an intra-uterine douche. He believes that in these cases the curet is especially dangerous.

Indications.—A valuable book upon an important subject is that by Winters on "The Induction of Abortion, Its Indication, Methods and Legal Standing" (*Der Kuenstliche Abort. Indikationen, Methoden, Rechtspflicg fur den Geburtshilflichen Praktiker*, Stuttgart, Ferdinand Enke, 1920).

The motto of the author is no unnecessary abortion and no omission of a single necessary one. Winters found in his clinics that the induction of abortion is justifiable in from 25 to 42 per cent only. The indications are the toxicosis of pregnancy, diseased conditions of the ovum, disease of the internal organs, the brain and its appendages and of the special senses. He also recognizes that there are eugenic and social reasons for abortion. In tuberculous cases he declines to induce abortion in all cases where the tuberculous process is latent, although he believes that the patient will grow worse without the interruption of pregnancy in 20 per cent of the cases. In active tuberculosis he would terminate the pregnancy. Hereditary diseases of importance justify interruption, including dementia præcox, idiocy, severe epilepsy, ataxias, spastic spinal paralysis and chorea, including retinitis pigmentosa. Where pregnancy has resulted from rape, he does not consider interference justifiable.

The laws upon the induction of abortion existing in Germany are reviewed.

Active Principles of Ergot.—Clark (*Brit. M. J.*, April 23, 1927) drew attention to epidemics of ergotism during which abortion occurred frequently, and the observation of this fact led to the use of ergot in therapeutics.

Ergot given by the mouth increases the force and frequency of uterine contractions within twenty minutes, and this action is so powerful as to be dangerous if there is any obstruction to the birth of the child. The active principles of ergot are unstable. The chemistry of ergot was for a long time not made plain; the isolation of the hydrate of ergotinin produces a substance which has the effects of ergot. Other specific alkaloids have been prepared from ergot. In addition to alkaloids, ergot contains a mixture of decomposition products, tyramin and histamin, which produce increasing action when given hypodermically, but have very little action when given by the mouth. When ergot is given by the mouth these substances have little value in the result. The therapeutic action of ergot depends entirely on the specific alkaloids of which it contains 1.1 to 0.2 per cent. Many preparations of ergot are practically inert and the process of preparation usually employed results in the loss of 97 per cent of the active principles, with the exception of the ammoniated tincture, in which one-fourth of the active principle is retained.

He comments upon the fact that obstetricians have for so long used preparations of ergot known by chemists and pharmacists to be inert.

Cervical Attachment of the Placenta.—Recently the danger of the cervical attachment of the placenta has been brought to the attention of the profession by Freund, Humm and other continental obstetricians (*Ztschr. f. Geburtsh. u. Gynäk.*, 1923, Band 85, 581). In Freund's 25 cases, the maternal mortality was 80 per cent. His patients had violent hemorrhage usually follow-

ing the first cervical and vaginal examination. The behavior of the case is characteristic of advanced cancer of the uterus, the tissues give a similar sensation to the finger, and the hemorrhage is profuse. It is almost impossible to recognize the cervix, so greatly is it altered. One of the principal causes of bleeding is varicose vessels which develop in these cases. In one patient he could not detach the placenta as the cervix tore during the effort, and he was obliged to extirpate the uterus by abdominal section followed by fatal shock.

In one case Bumm exposed the cervix and ligated the most important vessels and checked the hemorrhage.

These cases were reported before the Berlin Obstetrical Society and the consensus of opinion was that cesarean section in one of the various forms is the only possible means of delivery in this very serious complication.

Placenta Accreta.—Under the title "Placenta Accreta," Polak and Phelan (*Surg., Gynec. & Obst.,* Feb. 1924) contribute an illustrated article giving their experience with this complication. They estimate the frequency at 1 in 6000 cases. This condition must be differentiated from simple adhesion of the placenta which is of little importance. Placenta accreta is a definite pathological condition. So completely is the placenta interwoven with the cervix that manual removal is impossible and can only result in hemorrhage, septic infection, or perforation of the uterus. Whenever the expulsion of the placenta is delayed, suspicion should be aroused, and if there is clinical evidence of separation Credé's method should not be tried. Where the placenta is retained without hemorrhage a thorough exploration should be made under anesthesia to decide the method of treatment. If gentle and careful manipulation fail to demonstrate a line of cleavage between the placenta and uterine tissues, hysterectomy or total extirpation of the uterus is indicated.

The writers during the past five years have had 8 manual removals of the placenta. Three were partially or completely adherent, but line of separation could be found and the placenta was finally delivered. Four were separate from the uterine wall but were retained by a retraction ring. There was one case in which no line of cleavage could be demonstrated, the placenta was removed piecemeal and not completely, accompanied by such severe hemorrhage that nothing could be done but firmly pack the uterus and give stimulation. While an effort was made to find a donor for transfusion, the patient died, nine hours after admission to hospital. In two other cases the attempt to remove the placenta by manual interference was followed by such hemorrhage that packing was used, but the patients died of septic infection. Both of these cases were multiparæ and previously had had the placenta removed by the introduction of the hand. In a third case narrated the woman was aged 26, married five years without pregnancy. She had had four curettings. When in labor the uterine tumor was very large and a small hard tumor was found just above the pubis in the left lower quadrant. A stillborn seven months' fetus was delivered after five hours of labor. The placenta was not expelled and there was no hemorrhage. The uterus contracted intermittently and Credé's method failed to express the placenta. Six hours after delivery, in hospital, under anesthesia and asepsis, the gloved hand found in the lower

segment, just before the internal os, a submucous fibroid as large as a grapefruit attached to the anterior left uterine wall, the placenta was above the tumor and no line of separation could be made out. The abdomen was opened and the uterus incised at the right edge of the placenta. An attempt was made to separate the placenta, but this attempt failed. Supravaginal hysterectomy was followed by an uneventful recovery.

In the *Journal of the Canadian Medical Association,* February, 1927, Foster reports a case of placenta accreta, the only one observed among 8000 deliveries in the Montreal Maternity Hospital during six years. The decidua was absent in this case at the placental site, the villi penetrated the uterine muscle and separation of the placenta was impossible. In other forms of adherent placenta there is always basal decidua.

If the cause of this condition is searched for, too vigorous curetting, chronic endometritis, submucous fibroid and previous manual removal of the placenta are found. In the writer's case the patient was aged 32 and had had previously three pregnancies; none were terminated artificially, but the second child was stillborn because the mother received a blow on her abdomen, and after the birth of this child the placenta was removed with instruments. With the third child the placenta was removed manually, hemorrhage was suffered and the patient was two months in bed. In her fourth pregnancy at term the blood-pressure was 132—82. There was a trace of albumin in the urine, some backache and bleeding from the vagina. At birth the fetus was dead in breech presentation and there was difficulty in delivering the after-coming head. Effort to remove the placenta brought away only two small cotyledons. Hysterectomy was done, when it was found that the placenta extended over the whole of the interior of the uterus; it varied in thickness and no normal line of cleavage could be found. Microscopic examination of the sections showed that decidua was absent.

Premature Separation of the Normally Implanted Placenta.—This remains one of the most formidable complications of pregnancy. Scott (*Surg., Gynec. & Obst.,* April, 1924) reports 9 cases in the Evanston Hospital, of this complication. He draws attention to the association of toxemia and its probable identification as the cause of the accident. Cases are cited illustrating this contention. One of the cases which he delivered was a primipara aged 30, pregnant seven months, blood-pressure over 200, albumin present in the urine and an increase in the uric acid of the blood. Acute abdominal pain and faintness developed during labor with partial cessation of the pains, which was treated by inserting a dilating bag. In six hours complete dilatation was present and a stillborn child was delivered. Three quarters of the maternal surface of the placenta was occupied by a firm clot. Microscopic section of the placenta showed thickening of some of the walls of the arteries, although the chorionic villi were normal.

The second case was also a primipara with high blood-pressure and edema, delivered by low forceps of a living child. On examination of the placenta, infarcts and a clot were present.

Other illustrated cases are reported. Three cases are studied from the

writer's clinic in which the separation came on suddenly and was accompanied by hemorrhage which escaped externally. These patients were treated by prompt delivery, one of them by section, and the recovery of the mothers followed. In two of the three a living child was secured.

From the literature he quotes 3 cases in which the placenta was delivered, before the child; a stillborn child was spontaneously expelled some time after. In these patients the uterus resembled an ovarian cyst with twisted pedicle; blood had been effused extensively in the uterine wall or under the peritoneum, and one half of the uterus was apparently normal and the other greatly altered. The tendency of the hemorrhage is to separate and draw apart the muscular structure of the uterus forming cysts which are filled with blood. Where successive effusion of blood occurs, round-cell infiltration in the neighborhood of these foci has been observed. This process is more pronounced near the fundus and upper part of the uterus and is rarely found in the lower uterine segment. The placental site is most involved and the accident is usually more pronounced on the anteroposterior or lateral aspect of the uterus in accordance with the site of the placenta. The condition is most fully developed and destruction of tissue greatest just beneath the peritoneum; here the uterine wall is literally torn apart by the excessive bleeding. In nearly all cases the uterine muscle is considerably degenerated and this is most advanced where the bleeding is greatest. This degeneration is not caused by the hemorrhage but is produced by the toxemia which results in the bleeding. In some cases the individual muscle-fibers could not be recognized. In the decidua the walls of the vessels are degenerated and there is necrosis of the decidual cells, in the veins or walls of the vessels and where the veins are in direct connection with the effused blood. Thrombosis was present in some cases, infiltration about the vessels in others and there were multiple fissures in the peritoneum sometimes extending into the muscular tissues beneath. This peritoneal lesion was found in 15 per cent of cases. Usually the tear is transverse, sometimes longitudinal, occasionally irregular. These lesions are observed at the fundus on the anterior or posterior wall; as would be expected, they are often at the site of the placental attachment.

In one case, reported by White, among the very earliest, the woman aged 32, in her ninth pregnancy, after giving birth to a dead child, died in about an hour. At autopsy there were peritoneal lesions, extravasations into the broad ligament, and blood was also extravasated into the abdomen. Effusion into the peritoneum was found in 71 per cent. Sometimes this is clear serum and again bright blood.

In 26 of the cases collected, the broad ligaments were involved, the tubes in 11, the ovaries in 4, the round ligament in one. Multiform bleeding was the lesion most often found. Extravasation of blood may extend over a very considerable area. The placenta does not seem to be pathological and the only condition found has been slight thickening in the stroma of the ovary. There are the records of 17 autopsies with subcapsular hemorrhage in the liver and acute parenchymatous degeneration. In one case there was hepatic cirrhosis and in one the extreme statement was made that there remained

no normal liver tissue. The kidney showed parenchymatous degeneration and there was bleeding in the diaphragm, in two cases; in the pericardium in one, in the meninges one, in the stomach two, and in the adrenals one.

Autopsy on the fetus showed hemorrhage into the viscera. Whether this was caused by asphyxia from placental separation or by toxemia, it is difficult to state.

That placenta prævia and accidental separation can be combined, Scott believes, and supports this belief by the description of 2 cases in which the mother died and in which the conditions indicated placenta prævia and separation as well. These patients were not seen until the bleeding had become severe. He cites 3 cases treated obstetrically, as he terms it, in which the mother recovered with the birth of a dead child; delivery was spontaneous. In other patients interference was practiced, and if this was done sufficiently early, the results were favorable.

The writer believes that mild cases of premature separation of the normally implanted placenta are not infrequent. They are toxic and traumatic, the greater portion being toxic. Where the toxemia is mild, small areas of infarction with comparatively slight bleeding develop, which cause the mother but little disturbance, but end in the death of the child. The same toxemia which is seen in eclamptic patients is present in these. If the symptoms are not threatening, the author would use expectant treatment, but if symptoms indicate a condition of severity, delivery by cesarean section is indicated.

Stimulation of the Uterus.—*The method by which the uterus is stimulated* has always been of interest to physiologists and especially to obstetricians. Whitehouse and Featherstone (*J. Obst. & Gynæc. Brit. Emp.*, 1923, 4: 565) utilized several abdominal cesarean sections and other operations as well as normal cases, to study the stimulation of the uterus. They added to this experiments upon rabbits and concluded that the nervous mechanism controlling the uterus is local, sympathetic, and lumbosacral and automatic. The local nervous stimulus produces rhythmical contractions of the uterus independently of the other sources of stimulation. This physiological fact is true of other involuntary muscles. The sympathetic nerves increase the action of the circular muscle-fibers and inhibit the action of the longitudinal bundles; the nerve-centers in the lumbar cord stimulate the longitudinal fibers and inhibit the action of the circular fibers. Centers in the medulla and possibly the cortex, control both automatic and sympathetic stimuli, but these centers can act independently. Reflexes are important factors in normal contractions of the uterus, illustrated by reflexes from the breasts and reflexes set up by stretching or irritating the perineum. To have efficient uterine contractions both automatic and sympathetic nerve systems must be in a condition of health and there must be a balance between them; if there is disability there will be interference with normal labor.

Acting upon these observations the authors conclude that for classic cesarean section lumbar narcosis used alone or combined with general anesthesia, would be advantageous. If this method were employed they would limit the inhibitory stimuli from the lumbar portion of the cord and allow

the sympathetic stimulation to produce firm contractions of the circular muscle. This should prevent bleeding. In one of their cases the fetus and five fibroids were removed at full term by operation, with very little hemorrhage. If one can get the circular fibers to contract strongly, the edges of the uterine incision are drawn up, which makes the closure of the muscle much easier and more efficient. If there is an indication to increase intra-uterine tension, the use of cocain in the lumbar region should do this and this treatment might be of advantage in premature separation of the normally implanted placenta. In placenta prævia the bleeding might be reduced temporarily by the contraction of the lower segment, but when the placenta was separated the bleeding would increase. In cases of exhaustion during labor, the uterus failing to act, spinal anesthesia should hasten delivery and lessen danger of bleeding. This also should reduce the quantity of blood lost from the placental site. When it is desired to empty the uterus through the vagina in early pregnancy, the writers prefer spinal to general anesthesia. Cases are sometimes seen where the cervix is rigid and a contraction ring develops which greatly retards labor; this is caused by excessive stimulation of the sympathetic system, and in the non-pregnant this may be an important factor in producing dysmenorrhea.

In normal labor spinal anesthesia is not indicated; it will retard the dilatation of the cervix and lessen the expulsive power of the uterine muscle and increase the necessity for the use of forceps.

Bacterial Content of Uterus during Pregnancy.—This subject, which has occasioned much discussion, has been studied by Harris and Brown in the cases treated by cesarean section at the Johns Hopkins Hospital (*Am. J. Obst. & Gynec.*, Feb. 1927).

It is now commonly thought that up to the time that labor begins, the pregnant uterus is free from bacteria. Should, however, labor be prolonged and intra-uterine manipulations be practiced, infection is frequent. It is of particular importance to know when the bacterial invasion occurs, and what are the factors which control it. These are usually supposed to be examinations through the vagina, the time elapsing after the rupture of the membranes and also the duration of labor. It is usually believed that when bacteria invade the uterus, the temperature soon rises.

There can be no question but that vaginal examination made during labor increases the danger of infection. It is too soon yet to judge whether the practice of rectal examinations, instead of vaginal, will essentially lessen the danger of infection, but even when no vaginal examinations are made during labor, it does not necessarily prove that the uterus is free from bacteria.

In 50 cases studied by the writers, the lower uterine segment gave positive cultures in 22, and in 13 of these patients there had been made no vaginal examinations during labor. We must therefore conclude that the absence of vaginal examinations in labor does not make certain the absence of bacteria from the uterus.

The study made by the writers emphasizes the danger of bacterial invasion of the uterus when the membranes rupture prematurely, but this circumstance is not invariably present in cases of infection. Out of 22 patients having

premature rupture of the membranes, from whom positive cultures developed, in 7 spontaneous rupture of the membranes had not occurred, and the membranes were ruptured artificially during the delivery of the child by cesarean section. Intact membranes are not a thoroughly reliable barrier to the entrance of bacteria to the lower uterine segment.

That prolonged infection in the uterus causes fever is certain, but there are exceptions to this rule, for in 22 patients with positive cultures, temperature was normal in 14. Of the remaining 8, 2 of them had temperature less than 100° F. Where, however, the uterus was sterile at the time of operation, the temperature was normal. These and similar observations show that the presence of a normal temperature is not a reliable indication that bacteria have not entered the uterus.

In the 50 cesarean sections, there were 19 that were elective, the operation being performed at a time chosen in the end of pregnancy and before the membranes had ruptured. In these cases the uterus was invariably sterile. This was also true of 6 cases of the classic section, where within four hours after the beginning of labor the operation was performed.

There were 5 cases of classic section where the operation was done six or more hours after labor began and in these patients bacteria could always be found in the lower uterine segment, and in 3 of the cases streptococci were demonstrated. In 13 low cervical and 6 sections followed by hysterectomy, the only cases in which the uterine cavity was found sterile, were 3 in which the operation was done within a few hours after labor began.

These results demonstrate clearly that it is safe to perform a conservative cesarean section only in cases of election, before vaginal examinations have been practiced and the membranes have ruptured and before labor has developed. While vaginal examination and premature escape of the amniotic liquid make the invasion of the uterus by bacteria more probable, one cannot conclude positively that the uterus is sterile if these factors are not present, nor can a normal temperature be considered a positive proof that an ascending infection is not already present.

The process by which bacteria enter the uterine cavity is not yet clearly shown, whether by the passage upward of bacteria already in the vagina, or whether bacteria from the vulva may cause an ascending infection, and until a complete study of the germs normally found in the birth canal has been made, this question cannot be answered.

Transplacental Passage of Bacteria.—Laffont and Mele (*Bull. Soc. d'obst. et de gynéc. de Par.*, 1926, 15) report the case of a woman aged 24 admitted to hospital for nervous disturbance complicating pregnancy. Premature labor was threatened and opium was given. Facial paralysis and vomiting developed with a temperature of 103-104° F. There were signs of meningitis and the spinal fluid contained pus.

The laboratory report showed a *Staphylococcus meningitis*. A blood culture was positive. The patient became comatose and delivered herself of a female child that died one-half hour later. The mother died with bulbar paralysis.

After the death of the child its heart was punctured, the cardiac wall having been sterilized by the thermocautery; the blood extracted from the heart showed a growth of the staphylococcus.

Relation of Hemolytic Streptococci to Pregnancy.—The old question of the relation of hemolytic streptococci to pregnancy and the puerperal period is discussed by Kanter and Pilot (*Surg., Gynec. & Obst.,* Jan. 1924). They quote the literature of the subject and studied 96 patients in the Presbyterian Hospital and Dispensary of Chicago. To obtain the secretion they inoculated swabs, one from the lateral wall of the vagina, the second from the posterior fornix, the third from the os and the cervix. The latter two cultures were taken with sterile speculum and care was taken to avoid the secretions present. They also made studies to determine the possible source of streptococcus infection in puerperal patients, and especially the nasopharynx of the patient and her attendant. They found that the normal vagina rarely contained virulent hemolytic streptococci, nor was there evidence that the presence alone of such streptococci produces puerperal sepsis. Any manipulation or disturbance of the vagina by examination or operation, increases the risk of sepsis. Puerperal hemolytic streptococci infection is considered by most to be exogenous. Drops of secretion from the nasopharynx of the attendant may infect patients and the use of gauze masks is indicated during delivery, and also the exclusion of all persons suffering from sore-throat from the delivery room and attendance upon puerperal patients.

Formation of Abnormalities in the Placenta.—The formation of hydatid mole and abnormalities in the placenta have received the attention of Keller (*Gynéc. et obst.,* 1924, 1). He found in 7 cases of hydatid mole, degeneration of the villi caused by alteration in the circulation of the part. In moles the villi are almost completely absent and what are present are the lacunæ which were the original blood channels during the development of the embryo. The origin of these abnormalities in the circulation is at present unknown.

In 116 cases of marginal placentæ, Keller found that an important factor was a fibrous ring in different stages of development at the border of the internal os, where the edge of the placenta came to the edge of the os. In some cases there was necrosis of the villi; in others, of the decidua with hemorrhage. This fibrous ring is sometimes the result of the stagnation of blood in the intervillous spaces at the border of the placenta. This may develop at the sixth or seventh month by the unusual growth of the two placental surfaces. There is then a margin between the two placental surfaces which is outside the chorion. In a small number the placenta is inserted into the uterine cornu; here the chorion is situated at the border of the placental lip which covers the orifice of the tube; that is, fibrin is deposited and the superficial villi increased. The fibrous ring is thus formed outside the chorion. Occasionally one of these placentæ results from the fact that a portion of the decidua reflexa at the placental margin, persists and is not absorbed. A marginal placenta may produce bleeding in pregnancy; this would be followed by partial separation, very rarely by total separation, but often by premature labor. The placenta prematurely separates in these cases not infrequently.

In others hemorrhage results because the placenta separates especially where a marginal placenta is at the tubal orifice. Unless the hemorrhage is severe, the condition is often not recognized positively until delivery. The membranes in 116 cases ruptured prematurely; in 17 there was atony of the uterus, which is five times more frequent in these than is usually the case. There is no evidence that this condition interferes with the growth or development of the fetus.

In the *American Journal of Obstetrics* for August, 1924, Bagg contributes an illustrated paper showing the result of experiments upon animals with x-ray and other agencies, in the production of malformation. Structural defects in the young are produced by arrested development from disturbances in the circulation. In some, impure blood enters the vascular endothelium producing malformation. If such extravasation occurs during the critical period in the development of an organ, it may interfere and lead to defect in structure. In experiments, the eyes of animals are readily affected by interference with the animal, because the blood-vessels of the head are often turgid and easily permit the extravasation of blood. In the extremities, club-feet and syndactylism are produced. Sometimes organs like the kidneys are interfered with and may be partially or wholly affected in development. In the unborn, birth injuries by instruments, or pressure by maternal pelvis or partial asphyxia, or increased blood-pressure in the infant during labor, may produce lesions in the head. Small hemorrhages have, however, been found in cases where the child was not subjected to pressure, as in those examined in the uterus during cesarean section. From congenital nevi we learn that such blood disturbances may occur before the birth of the child.

The study of the development of abnormal structure adds nothing to our knowledge regarding the cause of club-feet or paralysis and malformation of the lower extremities, but there is distinct evidence of interference in the development of the eyes.

Ectopic Pregnancy.—*Leukocytosis.*—That leukocytosis has a relationship to ectopic pregnancy is intimated by Gragert (*Zentralbl. f. Gynäk.*, 1923, 40: 17). He finds a normal leukocyte count in ectopic pregnancy where there has been no hemorrhage or inflammation of surrounding tissues. In the absence of these a slightly increased leukocyte count gradually becomes normal. A tubal abortion is usually accompanied by slight hemorrhage which has little effect upon the leukocyte count. This differs very much in different patients, as some are greatly irritated by hemorrhage and others are not. After tubal abortion develops, there is a drop in hemoglobin percentage and the number of red cells, the rapidity of this process being in proportion to the severity of the bleeding. Where there is a recent rupture of the tube the blood is markedly altered, the leukocyte count remaining normal. Where the bleeding is gradual but continuous, the leukocyte count is altered. These facts may aid in making a differential diagnosis between inflammatory condition and ruptured ectopic pregnancy. From the leukocyte count and diminution in hemoglobin and red cells, a differential diagnosis cannot be made between ectopic tubal pregnancy and rupture and ovarian tumor with twisted pedicle.

If the patient shows normal leukocyte count but a rapid fall in hemoglobin and red cells, it will indicate rupture of the tube and not perforation peritonitis.

Anuria.—Horvat (*Zentralbl. f. Gynäk.*, 1923, 45: 1735) reports a case of ruptured tubal gestation with absolute anuria as the extraordinary symptom. After the removal of the ectopic tube, the secretion of urine became normal. The urine tests remained normal and although the patient's recovery was complicated by bronchitis she ultimately did well.

An interesting case of ectopic pregnancy was described by Mertens (*Zentralbl. f. Gynäk.*, 1923, 45) in an ovary which showed on removal two cavities filled with blood: In one a corpus luteum filled with blood, in the other placental villi and syncytial cells.

Broad Ligament.—An ectopic pregnancy in the broad ligament is reported by Pfeiffer (*Monatschr. f. Geburtsh. u. Gynæk.*, 1923, Band 65, 85) in a patient aged 28 who had had pain in the lower abdomen and yellowish discharge for one and a half years. Menstruation had been regular without much suffering. About a month after her period she came to the hospital complaining of pain which rendered work impossible. There was no vaginal hemorrhage, the tumor was as large as a fetal head in the abdomen near the uterus. The uterus was enlarged, pushed to the left, the tumor was very sensitive. There was some rise of temperature, and gonorrhea was found in the cervix and urethra. The patient was thought to have pelvic inflammation with pyosalpinx.

With rest in bed the pain became less and temperature normal and, after three weeks in hospital, the patient left, to return in eight days. The tumor had not become smaller and accordingly the abdomen was opened. There were abundant adhesions between the intestines, omentum, and abdominal wall, and it was necessary to resect a portion of the omentum. The uterus was separated from adhesions and found very little enlarged and the pelvic organs were affected. On the right side the tube seemed normal near the uterus, but then became very much shorter, and terminated apparently at the pelvic wall. The peritoneum on both layers of the broad ligament was intact. The ovary was intact and fairly movable and, upon opening the anterior layer of the broad ligament and ligating the vessels, the tumor seemed to be intraligamentary. It was firmly adherent to the internal surface of the ovary. After the tube was tied and separated there was no difficulty in removing the tumor. A corpus luteum could not be found. The left tube was closed as the result of inflammation.

On examining the mass removed, the tube, clot, and villi of the chorion were plainly evident.

Extra-uterine pregnancy at full term is reported by Catlin (*J. Am. M. Ass.*, Jan. 12, 1924) in a primipara. At the sixth week of gestation she had an attack of pain and faintness. She went almost to term when pain and faintness again occurred and were repeated on the following day, and after that pain and fever and she became so ill that food could not be retained and the bowels did not move for two weeks. She was taken to hospital and anesthetized and a pessary placed in the vagina to support the uterus; this was kept

in position five weeks. She left the hospital and had another attack of nausea, after which she felt better. Fetal movements developed and fetal heart sounds were unusually plain. The child moved excessively on one occasion and then movements ceased entirely. When examined the breasts contained slight secretion, the cervix was soft and the body of the uterus could not be made out. On the left side of the abdomen a bruit could be heard but no fetal sounds. It was thought the uterus contained a dead fetus and it was decided to bring on labor by packing the vagina and cervix with gauze. Four days after this the patient was anesthetized and the cervix dilated and the uterus found to be empty. She was then removed to the hospital where x-ray showed the fetus in a sitting posture with the head at the margin of the ribs and the feet in the left iliac fossa, the back in front, and the shadow of the placenta seemed to be on the left abdominal wall. On section a thin amniotic sac was adherent to the transverse colon and small intestines. It was opened at the edge of the placenta and the fluid carefully removed and the child delivered. It was 55 cm. long and weighed 7½ pounds and had been dead several weeks. When an effort was made to remove the placenta hemorrhage was so great that it could not be continued. The sac was sewed to the peritoneum and the wound left open and packed with gauze which was changed daily. About thirty days after the operation the entire placenta was removed. The wound was kept packed with gauze and several ounces of 1 per cent dichloramin-T were poured into the cavity daily until it became sterile and the abdomen healed perfectly.

It is believed that the wide open drainage and antiseptic precautions saved the patient. Incision was made along the border of the right rectus muscle and this aided in the rapid closing. The blood-vessels at the placental site did not become obliterated until forty-three days after the death of the child.

Uteroplacental Hemorrhage.—The familiar complication of uteroplacental hemorrhage is reported by Rivière (*Bull. Soc. d'obst.*, 1923, 12, 543) in 2 cases. In one lumbar puncture of the child showed bloody cerebrospinal fluid. The child was delivered by forceps, cried feebly on extraction and the placenta was at the fundus and readily detached and delivered with a considerable quantity of blood. The mother recovered without complication, although she had shown some evidence of shock during the labor.

In the second case, a primipara in seventh month, the urine showed a small quantity of albumin and the patient would not permit examination. After a fatiguing day, she was taken with violent abdominal pain, hemorrhage, and diarrhea. She became greatly excited, delirious, and very pale, the pulse was regular at 60 and there was moderate external hemorrhage. The uterus was very hard, the cervix firm. No heart sounds could be heard and the lower segment was firmly closed upon the child. Upon admission to the hospital the urine contained a considerable quantity of albumin. At section a reddish fluid was found in the peritoneal cavity, the uterine wall was extremely thin, the placenta was in front and on the right, partly separated by a clot. On the posterior wall of the uterus there were two large ecchymoses, one on each side of the median line. As the uterus contracted and retracted

well as the sutures were inserted, it was not removed. The patient's pulse rose to 160 with extreme shock from which she gradually recovered.

Plastic Changes in Vagina.—Runge (*Arch. f. Gynæk.*, Band 122, Heft 3, 1924) has made an elaborate study of this subject to determine the chemical and anatomical changes which go on in the vagina as pregnancy develops. He paid especial attention to the so-called colloid chemistry of the tissue. He distinguishes two stages of the process, one of which develops as pregnancy advances, and the other is accomplished in a comparatively short time during parturition itself.

The first stage, which is gradual, consists in the distention of the elastic tissue with the formation of certain colloid materials which permit a very considerable alteration in the structure of the part. The second stage, which is more acute, the author describes as edema of the vagina developing at the beginning of labor.

Air Embolism Complicating Pregnancy and Parturition.—This question has long given rise to discussion. Experimentally it has been reported that air can be injected into the circulation without especial disturbance to the patient; in other cases immediate and the most serious results seem to follow. Hazelhorst (*Arch. f. Gynæk.*, 1924, Band 122, Heft 3) has studied this subject with the aid of the x-ray and illustrates his paper by skiagrams showing the condition of the heart when air has entered the circulation. His researches seem to show that air which enters the right side of the heart, passes with little disturbance to the circulation, into the pulmonary arteries and oftentimes causes no especial result. The air is in bubbles and the effect which it produces depends much upon the size of the bubbles, as the ultimate result is embolism of the larger or smaller terminals of the pulmonary artery. The size of these bubbles of air all depends upon the length of time during which the air remains in the heart and upon the strength of cardiac contractions. The longer the air remains in the chambers of the heart the smaller are the individual bubbles which develop. Where these bubbles of air are greater, the large vessels in the lungs are sooner obstructed and where they are smaller, the obstruction occurs in the vessels of ordinary or smaller size. When embolism in the vessels of the lungs develops there is a fall in pressure of the circulation at large and a corresponding rise in the pressure in the right heart and the pulmonary vessels. If the heart cannot overcome the disturbance to the circulation, there follows a very essential compression which extends to the left heart and which prevents the distribution of blood to the organs. The heart itself suffers in its nutrition and consequently in the performance of its function. The anemia in the central nervous system which results in this condition increases the general failure of the circulation, and death from venous air embolism results, primarily from emboli in the pulmonary vessels as a result of this insufficient heart action and sudden and intense anemia in the many organs of the body.

So far as practical deductions can be drawn, there seems to be no distinct separation between prophylaxis and therapy. The author warns against conducting obstetric operations with the pelvis of the patient raised. This pos-

ture, he believes, causes negative pressure in the veins of the pelvis and favors the entrance of air into the uterus and vagina. Should air have entered, he believes that this position only increases the danger. Where the head of the patient is raised, if air has entered the right side of the heart, the tendency is to limit it to the pulmonary circulation and not to affect the entire system. He recommends for pelvic and obstetric operations, a horizontal position upon the back.

As far as drugs are to be considered, those substances which quickly stimulate the action of the ventricles are useful; such are camphor, caffein, strophanthus, and adrenalin. If possible, puncture of the ventricle should be made as soon as it is seen that air has entered the heart. While this is useful, to be successful from 10 to 20 c.c. of air mixed with blood must be removed to produce a definite result.

The author recognizes the hopelessness of many cases if once a considerable quantity of air has entered the circulation.

Pregnancy after Nephrectomy.—Borelius (*Monatschr. f. Geburtsh. u. Gynæk.*, 1924, Band 67, Heft 6) cites the cases of 6 patients who after nephrectomy had one or more pregnancies and were confined under observation in the hospital. Four of these patients had their surgical operations in the hospital, and the histories are available of 3 cases having six confinements in other hospitals and these were seen and examined by physicians shortly after labor had occurred. The nephrectomies were done for stone in the kidney, tuberculosis of the kidney, and pyelonephrosis. One patient after nephrectomy for stone in the kidney had three normal pregnancies and confinements. One who had a markedly tuberculous kidney removed, had two normal pregnancies and confinements and remained well on recovery from them. One patient had nephrectomy for pyelonephrosis threatening abortion but was finally delivered with forceps. During the puerperal period she had severe pyelitis caused by the colon bacillus. She finally made a good recovery but remained in a highly nervous state. Another patient had a kidney removed for tuberculosis and after that a normal birth complicated by colon bacillus infection, then the removal of an ovarian cyst and after that two normal births, remaining finally in good health. Nine patients had fifteen pregnancies after nephrectomy, none had abortion or premature labor, and the pregnancies and labors were normal. It is remarkable how, after nephrectomy, pregnancy proceeds without complications: very few cases had albumin in the urine, none had eclampsia, and all did well. A few of them had pyelitis from which they recovered. In all of these 12 patients, pregnancy occurred some time after the nephrectomy; in 3 cases nephrectomy was performed during pregnancy and in 2 of these there was no disturbance in the pregnancy; the third patient had a pyelonephrosis and was threatened with abortion which was checked by morphin and the patient went to term. One patient had symptoms indicating disease of the kidney for twelve years and during this time had two successful pregnancies. During the third pregnancy the condition became so much worse that nephrectomy was performed. A short time after the operation the urine became free from albumin and evidence

of tuberculous infection disappeared and pregnancy went on without disturbance.

In treating these cases every care was taken to know that the other kidney was healthy, the x-ray was used and the ureters were catheterized to make sure of this important point. In one case nephrectomy was performed although the urine from the other kidney was cloudy with trace of albumin, leukocytes and a few tubercle bacilli; the result, however, was good.

The weight of the children born after nephrectomy varied from 2850 to 3740 Gm. which is the usual weight. In most cases the right kidney was the one affected and removed.

The author quotes the literature of the subject which shows that the experience of other operators has been practically identical with his own. Where one kidney has been removed for tuberculosis and the second becomes involved, pregnancy usually causes so rapid and severe increase in the tuberculous process that fatal result soon develops. Most authorities believe that pregnancy influences tuberculosis of the kidney very unfavorably, tuberculosis of the bladder often develops and the ureters may become distended by retention of septic material and the tendency is for the disease to progress during pregnancy and the puerperal state. The question whether marriage should be forbidden in women in whom one kidney has been removed, may be answered in the negative provided the remaining kidney is healthy and the general health of the patient is good and from one to two years should have elapsed after the nephrectomy.

Changes in Ovaries Produced by Blighted Ovum.—Küstner (*Monatschr. f. Geburtsh. u. Gynæk.*, 1924, Band 67, Heft 6) cites the case of a woman aged 28 who had two spontaneous labors and no abortions and no severe illness. She believed herself to be pregnant and pregnancy was complicated by the spontaneous expulsion of a blighted ovum. Hemorrhage continued and became severe. The uterus was curetted and the diagnosis made of chorionepithelioma. When the patient was admitted to the hospital examination showed a tumor on the left side of the uterus about as large as a hen's egg which seemed to be connected with the uterus by a thin pedicle. The right ovary was somewhat large. There was a bloody secretion but no definite hemorrhage. Material removed for examination showed mucous membrane of the uterus with chorionic cells and characteristic appearance of malignant chorionepithelioma. The uterus and both tubes and ovaries were removed by abdominal section. Examination showed the characteristic lesions in the uterus and also in both ovaries. In the left side there was a small mass about as large as a cherry which proved to be malignant. On examination syncytial tissue was found distributed throughout all of the material removed.

The second case was that of a primipara aged 24 with a similar history and with similar pathological findings at operation. The interesting feature is that a very considerable time elapsed between the expulsion of the blighted ovum and the extirpation of the uterus by operation. The changes in the ovaries were characteristic and fairly well developed.

In the third case the changes in the ovaries did not show increase in lutein cells but otherwise the condition was the same.

In a fourth patient, aged 47, the operation consisted in removing the uterus and left tube and ovary allowing the right to remain. The characteristic lesions were found on examination. In a fifth case the findings were essentially those of the first.

In all of these patients there had been a blighted ovum expelled; lutein cells and corpus luteum cysts were present in cases where a blighted ovum was expelled, and also where chorionepithelioma had developed. Apparently changes in the ovaries begin at the same time that the blighting of the ovum takes place. Ordinarily when a blighted ovum is removed, changes in the ovary gradually disappear but in the cases mentioned and undoubtedly in others, the process goes on to the formation of a malignant growth.

Puerperal Sepsis.—*Etiology.*—Giles (*Brit. M. J.*, Feb. 19, 1927) states that infection from within as the cause of puerperal sepsis is relatively uncommon, occasionally a latent infection in the tube or appendix may produce sepsis, being set free by the anatomical alterations associated with delivery when confinement occurs. Without examination and interference, infection could scarcely develop except from a damaged and unrepaired perineum.

Labor therefore should be interfered with as little as possible. When interference is necessary the aseptic precautions adopted should be as complete as for surgical operation.

He urged an antenatal investigation of every case of pregnancy to detect possible innate foci of septic infection.

Notification.—This subject has for a long time occupied the attention of the British obstetrical profession (*Brit. M. J.*, Nov. 5, 1924). A recent discussion was conducted by several societies and the question arose as to whether the regulation proposed could be carried out. This regulation provides that when there is a rigor or temperature of 102° F. or higher for twenty-four hours, during the first ten days after confinement or abortion, that the case must be reported. The term puerperal fever is to be dropped and in its place puerperal sepsis is to be used.

In discussion it was shown that in some parts of the country the number of deaths from puerperal fever is larger than the number of cases actually reported. Some in discussion urge that septic cases be reported and thus that the patient be brought promptly under efficient treatment. It was thought by some that the term puerperal fever must be retained because it is understood by non-professional persons. A better supervision of obstetric practice is greatly desired. Eden believes that the notification of puerperal fever is not satisfactory. Fothergill estimated that not 4 per cent of the cases are reported; many of these undoubtedly occur after criminal abortion. The difficulties of the general practitioner were emphasized because frequently cases which he treats are found to be under practically the control of midwives who do not practice aseptic precautions.

On the whole it was thought that notification of the complications of

pregnancy and labor and the puerperal state was greatly to be desired and if possible, should be enforced.

Contracted Pelvis.—In the *British Medical Journal* for February 2, 9, and 16, 1924, are published three lectures by Fitzgibbon, Master of the Rotunda Hospital, on this subject. He states that the obstetrician should consider a pelvis contracted when its size or contour interferes with spontaneous delivery. Lesser degrees of contraction are especially dangerous because they do not occur in deformed women and often do not attract attention. Apparently small women frequently have successful labors so that it is not the actual stature of the patient which is important.

He states that a normal pelvis has an anteroposterior diameter of 4⅕ inches or 10.5 cm. and a transverse diameter of 5¼ inches or 13 cm. at the brim. The cavity is practically circular, varying from 4¼ to 5 inches in diameter. When the outlet is dilated it is practically circular with the average diameter of 4½ inches. The average normal infant weighs from 7 to 7¼ pounds and both diameters which engage in the pelvis in spontaneous labor measure 3¾ inches. It is important to remember that the size of the fetal head can be reduced by pressure. When one studies the ratio of the fetal head to the pelvis it is found that spontaneous delivery is possible more often than has been supposed. No general classification can be made which is practical but each case must be studied and treated on its merits on careful observation. While the degree of contraction may greatly alter the prognosis it very often does not exclude delivery through the pelvis.

The author is accustomed to study cases during actual labor where there is no great pelvic contraction or disproportion and if this be done accurately and early, from 70 to 80 per cent of cases of contracted pelvis terminate with no more difficulty than normal cases. Those requiring obstetric surgery can be taken to hospital and receive proper treatment before complications develop. If a patient with contracted pelvis can deliver herself, labor does her no harm, and injuries arise from prolonged or ineffectual labor which develops gradually.

He divides contracted pelvis into (1) symmetrically contracted, (2) small round or transversely contracted, (3) generally contracted flat pelvis, and (4) small flat pelvis. He draws attention to contraction of the anteroposterior diameter as the most important element influencing the prognosis for delivery. The transverse diameters are rarely reduced to any extent. In one year the author met 190 cases of contraction of the pelvis. These did not include those having an external conjugate of more than 18 cm. except among the round pelves and 2 cases with marked difficulty in flat pelvis. The average external measurements of these 190 were 23.25 cm. between the spines, 25.85 cm. between the crests, external conjugate 17.78 cm. The average weight of the infants was 7 pounds 3 ounces. In 99 consecutive cases treated by cesarean section for contracted pelvis in another hospital, the measurements were 9.2 inches between the spines, 10 inches between the crests, external conjugate 7.2 inches, and the average weight of the children 6 pounds 14½ ounces.

Symmetrically contracted pelvis the author considers usually as hereditary. Among these patients the proportion of low forceps application was not greater than the average. In one case, because progress lingered, section was done when it was found that the head had passed the brim so completely that it was necessary to use forceps to bring it up again. Among these patients 14.4 per cent required interference.

Sixty-nine cases of transversely contracted or small round pelves were seen; the anteroposterior diameter was from 20 to 17 cm. These were among the most dangerous cases so far as the transverse diameter was concerned and there was marked difficulty in delivery. In 14 vertex presentations among these cases there was marked difficulty at the brim where the head lodged. In 2 cases where the head passed the brim, the child was stillborn. Forceps were used more frequently than normally and the head was often excessively molded; 29 per cent of these cases were difficult.

There were 70 cases of generally contracted flat pelvis, the anteroposterior diameter not greater than 18 cm., and this produced no effect on delivery. One large child was delivered by low forceps followed by death from intracranial bleeding. Forceps delivery was not more frequent than the average. Two patients were delivered by section, one for a second time, although the children were about average size; one in her third labor had version. In a primipara the cord prolapsed with very slight dilatation of the cervix, the fetus died and the patient was delivered by craniotomy.

In 18 cases of small flat pelves the external conjugate was as low as 15.5 cm. There was difficulty in labor in 3 cases, 18.75 per cent, and forceps were used more often than the average. Thirty-three rachitic cases were studied in which the iliac crests were involved and gave evidence of the disease; rachitis, however, does not produce any one definite type of pelvic contraction, nor is it a very serious complication in labor and only 5 out of 33 patients had any difficulty.

In the whole series of 190 contracted pelves, 20 per cent had difficulty in labor. Cesarean section was performed 10 times, pubiotomy 8, forceps delivery 7, perforation after prolapse of the cord in one. Eight children were stillborn or died soon after delivery, of whom one was delivered by section, 4 by pubiotomy, and 2 by version and one perforated; as the section was done early in labor, there was no evident cause for the death of the child. Forceps were used in 12.1 per cent and there was more molding of the head than normal in these cases. In all cases in the hospital during this time the forceps were used in 7.3 per cent and in primiparæ in 16.66 per cent. This would indicate that forceps need not be used more often than the average in contracted pelves.

The writer places little importance upon contraction at the outlet of the pelvis. In his experience if the brim will allow the head to pass, there will be no greater difficulty at the outlet. He has never had difficulty in extracting the head after it has reached the outlet. He believes that cases reported of deformity of the outlet are really those of disproportion at the brim and

that this is not noticed until the head lodges in the pelvis. The difficulty in delivery arises from disproportion during the passage of the head to the outlet and consequent interference with mechanism. He does not measure the outlet but in the reports of other hospitals in 261 cases, 65 were reported as contracted at the outlet, of whom 41 ended in spontaneous delivery, 19 were terminated with forceps, one by section, and 4 not accounted for. He does not believe that one can estimate accurately the size of the fetal head before the test of labor. Women with contracted pelves tend to produce small children but not always small enough to balance the contraction of the pelvis. The principal indication of disproportion is the head high and movable above the pelvis; the soft tissues keep the head high more often than the pelvis does.

Fitzgibbon divides contracted pelves into minor, medium, and major groups. In the minor the true conjugate is larger than 9 cm. and the prognosis for pelvic delivery is good. In the medium the anteroposterior diameter is reduced to 9 cm. but not less than 8, and transverse not less than 10.75 cm. If the bitemporal diameter of the head can be substituted for the biparietal in these cases, spontaneous labor is possible and this depends upon the transverse diameter of the pelvis. He had 157 such cases and 14.6 per cent had very marked difficulty in labor. When the true conjugate is reduced to 8 cm., pelvic contraction becomes the major degree and a normal transverse diameter does not help. Of these he had 6 cases, of which 34.6 per cent had difficult labors.

Diagnosis should be made in prenatal clinics before labor and the conjugate and two transverse measurements, he believes, are most important. If the conjugate is less than 19 cm. the cavity of the pelvis is lessened. He used Skutsch's pelvimeter for internal pelvimetry. Radiography he believes impracticable. The fetal head and the pregnant condition obstruct the pelvis and he thinks that during labor patients cannot be transported to hospitals to obtain an x-ray picture of the pelvis and an expert is not always available to read the plates after they have been obtained. In emergency one often cannot get an x-ray picture.

Contracted pelvis does not influence pregnancy until the thirty-sixth week when descent should occur. The end of the thirty-sixth week is the best time to examine a case of contracted pelvis; complete examination under anesthesia may be indicated and about 70 per cent of cases will show good proportion and can go on safely to term. Cases of contracted pelvis should come into hospital at a calculated date for observation and treatment. Palpation and internal measurements are most valuable in studying these cases. If the promontory of the sacrum can be reached by vaginal examination, the internal conjugate is not more than 9 cm. The lateral edges of the brim should also be palpated and the relation of the head to the pelvic brim is most important. Where the head lodges against the top of the pubis the condition may be a grave one. If the head enters the brim the pregnancy may go on ten to fourteen days longer, but if the head impinges against the thumb of the examiner the head usually will not enter the pelvis and the pregnancy should be terminated.

If induction of labor is to be performed, it must be done promptly so soon as the disproportion is recognized.

In the first stage of labor contracted pelvis does not seriously interfere with the normal presentation; if the membranes rupture prematurely, then abnormality may develop. During the second stage of labor the influence of pelvic contraction is greatest, the cervix usually draws up leaving the head against the pelvic brim. In the second stage, molding is not excessive if the cervix continues to dilate. If this does not occur, the lower segment stretches and presses constantly upon the head and there is considerable molding. Well-marked molding is evidence of disproportion.

As to the mechanism of labor in contracted pelvis: Where the transverse diameter of the brim is lessened the head may be forced through with the posterior fontanel last and with excessive flexion. In small flat pelves the head moves laterally and accommodates itself to the brim; there is not much flexion until after the brim is passed and the head is flattened transversely; impaction results when the proportions between the head and pelvic brim are such that the head can engage but cannot be reduced by pressure sufficiently to pass. Contracted pelvis often calls for unusual uterine force and this may be followed by inertia or overdistention with rupture.

In treatment Fitzgibbon recognizes three methods: (1) Spontaneous delivery which includes the use of forceps after the obstruction is passed if excessive molding is not present; (2) the induction of labor; and (3) cesarean section. During pregnancy the induction of labor is the only treatment to be considered. At term the choice lies between spontaneous labor, or delivery by section. In inducing labor any time four weeks before full term may be selected. It is rarely necessary to induce labor as early as the end of the thirty-sixth week; more cases are taken at the end of the thirty-eighth week and induction of labor is indicated in 25 per cent of all pelvic contractions. His method is to introduce a small rubber tube, under careful aseptic precautions, If there is marked obstruction, cesarean section is usually indicated, although he believes that over 70 per cent of cases of pelvic contraction will deliver themselves spontaneously, under good care and observation. If the membranes bulge in a large bag into the vagina with the cervix partly dilated, section is usually required. Examination under anesthesia is very valuable. If the head has not passed the brim and the membranes have ruptured, vaginal examination is made within a half hour. If the cervix is fully or nearly dilated, and the head engaged with slight overlapping, the head will come down in a reasonable time and may be delivered safely with forceps. Labor may still go on if the cervix is only partly dilated if the head has entered the brim as a vertex and the cervix is closely fitted around the head. If the membranes have ruptured and the cervix is not applied to the head but remains as a vaginal portion, section is indicated in not less than six hours. A second vaginal examination should be made in all cases not delivered within four hours after the rupture of the membranes. Where the anterior lip is thickened and greatly lengthened, the head is greatly molded, the occiput may be posterior and the parietal bone may be presenting, spontaneous labor cannot be expected

and the use of forceps may cause the death of the fetus in 50 per cent of the cases. In proper cases pubiotomy may be performed but section is safest. These cases are serious because the forceps is often applied and failure of this attempt greatly militates against the success of operation.

Where a considerable portion of the vaginal part of the cervix has reformed, with partial closure of the internal os, the head high above the pelvic brim, section is indicated. The writer believes that cases are no less suitable for section four hours after rupture of the membranes than at the beginning of labor.

High forceps in contracted pelvis do more harm than good, in some cases pubiotomy makes the use of forceps successful. These cases should never be allowed to go to the point of great distress for the mother and forceps should be used on maternal indications. The forceps should complete delivery where the natural forces have failed to do so but have overcome the obstruction, and before the vitality of the patient is reduced by the useless prolongation of labor. Version, he believes, has no place in the treatment of contracted pelvis. Pubiotomy is easy to perform, safe for the mother, and saves the child. In the last four years the author has performed the operation 18 times, with the delivery of 13 living infants. Two mothers, previously infected, died; the child of one of these survived. He would never, however, with considerable disproportion and difficulty, allow labor to go on with the definite decision to perform pubiotomy; in all doubtful cases he would perform section. Craniotomy is usually proof of failure in treatment.

In a year the writer had 110 spontaneous normal deliveries with the death of 3 infants; one low forceps with the death of 2 infants; 5 low forceps with marked molding, and no mortality; 2 high forceps with no mortality; 4 pubiotomies with no mortality; 15 cesarean sections with 2 infant mortalities; 8 induced labors with death of one child; 5 induced labors terminated by low forceps, no mortality; 2 craniotomies; 2 prolapse of the cord terminated by forceps; 3 easy breech labors without accident; 2 face presentations converted into vertex; 4 twin cases without mortality; 8 premature children of whom 5 died; and 2 cases of macerated children; 184 deliveries with fetal mortality of 19.

Pelvic measurements averaged 7.2 inches for the external conjugate, the maximum being 7.6 and the minimum 6.6. The distance between the crests averaged 10.2, the maximum being 11.6 inches, the minimum 8.2.

Acute Abdominal Emergencies.—In the *British Medical Journal,* March 12, 1927, Fairbairn contributes a paper upon this subject. It seems a reasonable supposition that pregnant women should be more liable than others to acute mechanical disturbances of the bowel and of the spread of inflammation in the peritoneum, and this increased liability results from the displacement of the abdominal contents, with increased pressure, and the rapid change in these conditions following emptying of the uterus.

Pregnancy may greatly complicate a diagnosis, for vomiting, abdominal pain, distention and jaundice may exist in pregnancy without other abdominal conditions to produce them. After the third month of pregnancy the uterus

becomes an abdominal tumor and in later pregnancy abdominal physical signs are complicated and altered by its presence. The toxemia of pregnancy or the mechanical effects of abnormalities in the reproductive tract may produce abdominal symptoms.

Severe vomiting must not be considered as usual or normal in pregnancy. When the surgeon is summoned to a case presenting this symptom, he must exercise great caution before ascribing it at once to pregnancy. The vomiting of pregnancy usually begins about the time of the first missed menstruation and continues or may be worse, for two or three months. It is more severe in primigravidæ and tends to return in subsequent pregnancies in lessened degree, food recently taken is the vomited material, but later bile-stained fluid is present. Only in definite toxemias is coffee-ground material observed. There is constipation but the bowels may usually be moved by enema. The abdomen is sunken and not distended. When in pregnant patients vomiting begins after the fifth month, without evidence of toxemia, it should suggest an organic cause, especially if the vomiting rapidly becomes fecal.

Cases where vomiting arises late in pregnancy, where vomiting has not occurred in previous pregnancy, and where there is no evidence of impairment of renal or hepatic functions, require especial attention. Where the cause is not clear, the patient should be away from home under the care of competent nurses, so long as her condition so justifies and until a diagnosis can be made. If there is no definite evidence of renal or hepatic insufficiency, and treatment causes no improvement, the pregnancy should be ended. The writer narrates a case transferred to him by a surgeon, where there was pregnancy and continued vomiting; there was no albumin or jaundice and treatment was without avail, and the pregnancy was terminated at seven and one-half months. Shortly after, an emergency operation was performed for obstruction of the bowel from carcinoma of the colon, which had not been detected before the emptying of the uterus.

Pregnant patients showing symptoms of gall-stones or cholecystitis may present difficulty in diagnosis. Where there is toxemia, vomiting is pronounced, albuminuria is usually present and vomiting may become coffee-ground, jaundice is usually present. Cases are reported where the toxemia of pregnancy produces acute hemorrhagic hepatitis with jaundice and severe pain.

Maybury reported the case of a young woman, two months in her second pregnancy. She had had jaundice of a few days duration about five years previously, with pain in the left scapula, which soon disappeared followed by epigastric pain and slight jaundice, the whole being ascribed to gall-stones. When she was first seen in her pregnancy, the symptoms were like those of obstruction of the bile-ducts, the stools were clay-colored, the liver enlarged and a little tender, but the gall-bladder could not be felt. Medical treatment produced no improvement. On exploring the gall-bladder, it was found to be empty, nor was there a trace of bile in the common duct. From the right and left hepatic ducts a little dark material was removed. A tube was inserted into the common bile-duct and a drain to the transverse fissure,

and on the following day through both channels, bile was discharged. A fragment of liver tissue was examined showing undilated bile-ducts, no fat and slight degeneration of the liver cells. There was albuminuria with casts. The blood urea was above normal, and tests indicated a catarrhal jaundice. Spontaneous abortion developed, after which the patient died, apparently profoundly toxic.

The writer also quotes a case of a patient with severe vomiting once or twice daily, of a large quantity of brown and offensive fluid; apparently acute dilatation of the stomach was present. There was albuminuria and a high blood-urea content; coma developed but after the uterus was emptied the patient recovered.

The writer alludes to the causes of abdominal pain more or less directly connected with pregnancy, such as intra-uterine bleeding with a retention of blood. In concealed accidental hemorrhage, its sudden onset and collapse may produce a striking condition; this does not usually occur until the later months of pregnancy, when the uterus will be found fixed and tender, without signs of fetal life or fetal parts.

When a vesicular mole is present these symptoms may develop in early pregnancy and suggest an ectopic pregnancy with intraperitoneal hemorrhage.

Severe abdominal pain, collapse and signs of internal hemorrhage follow spontaneous rupture through the scar of a previous cesarean section. When blood leaks from a tubal gestation by rupture or gradual discharge, a marked abdominal crisis results. This usually happens so early in pregnancy that the diagnosis of pregnancy must first be made, and for this the history is all-important. The most common and least dangerous termination of a tubal gestation is the formation of a tubal mole which rarely gives rise to severe symptoms. This, however, causes pain, sudden in onset, and may be accompanied by faintness, vomiting and shock, and suggest a more serious abdominal cause. There is tenderness in the hypochondriac region, with a history of uterine bleeding, making the diagnosis remain between that of intra-uterine abortion or tubal abortion or mole. Later, when a swelling is recognized bimanually in the lower abdomen, the diagnosis may rest between tubal gestation or appendicitis. When a tube ruptures in early pregnancy, followed by profuse intraperitoneal bleeding, the symptoms are pronounced and the necessity for abdominal section is evident.

Acute necrobiosis, in a uterine fibromyoma, may produce severe abdominal pain; on examination a nodular enlargement of the uterus, tender on palpation, is found.

When a pregnant patient has an ovarian cyst, it is peculiarly liable to strangulation by torsion of the pedicle. The symptoms are often subacute but occasionally develop spontaneously and so severely as to stimulate strangulation of the bowel, and in hospital practice such cases are sometimes admitted and operated under a diagnosis of acute intestinal obstruction. Torsion is more common in small than in large ovarian tumors, and those in the abdomen rather than in the pelvis. An ovarian cyst which before pregnancy was in the pelvis may be drawn up into the abdomen with the uterus and not be recog-

nized until torsion of its pedicle develops. It may not be detected until pain, vomiting and distention occur. After torsion, hemorrhage into the cyst wall with increased tension develops, rendering the cyst more easily found by palpation, and when the cyst can be recognized, apart from the uterus, diagnosis is usually plain. There are a few cases on record of torsion of the pedicle of a pedunculated subperitoneal fibroid or presence of a fibroid uterus at the cervix, complicating pregnancy.

It is rare to find peritonitis, local or general, arising from infected tubes or ovaries during pregnancy. Infection of tubes and ovaries usually produces sterility. Those cases are sometimes seen where an inflammation has occurred at the same time as the pregnancy, and in others where infection has developed from the appendix or some other septic focus; pregnancy does not, in these cases, exclude the possibility of an acute spread of infection from the uterine appendages.

The pyelitis or pyelonephritis of pregnancy may simulate an acute abdominal emergency and has frequently caused the removal of a normal appendix. It is more common on the right side than on both, and least common on the left. The symptoms of appendicitis are often present. It is more common in primigravidæ and may be associated with cystitis. The diagnosis is made by the study of the urine and the detection of the *Bacillus coli communis* in the urine and the tenderness in the line of the costovertebral angle.

Pregnant women often complain of constipation and flatulence, especially in early pregnancy, but tympanites or constipation sufficiently severe to give rise to severe symptoms, is very unusual. There are a number of cases on record of ileus in pregnancy, including instances of intestinal obstruction due to mechanical causes, and of paresis of the bowel ascribed to the pregnancy as a mechanical effect of toxemic manifestations. If the cases reported are examined it is found that many of the cases of intestinal obstruction during pregnancy have been previously operated upon for some abdominal condition. Evidently the changes in abdominal contents associated with pregnancy and labor, may be especially liable to produce intestinal obstruction in patients having adhesions, hernia after operation or other such conditions. The fact that advanced ectopic gestation may give no symptom of its presence, explains some of the alleged cases of ileus. Mechanical interference with the intestines is most likely to arise when the uterus has become an abdominal organ, and labor with its marked change in the intra-abdominal pressure and contents, is the time when disturbance is to be expected.

Regarding appendicitis, it is thought that pregnancy has no tendency to increase its development. In late pregnancy, appendicitis is a serious complication because infection of the upper abdomen may develop and the descent of pus toward the pelvis may be prevented; abortion and labor spread the infection. Very often the pain of appendicitis complicating labor is falsely ascribed to some condition of the genital organs. When fetal movements cause pain in the abdomen, it is significant that the temperature is found unusually low and the pulse rate high.

So far as treatment is concerned it is safer to operate in infection of the

appendix and gall-bladder during pregnancy, than to allow the case to go on to its later development. Interference with pregnancy is rarely indicated; occasionally, as in carcinoma of the bowel causing obstruction, the pregnancy should first be terminated and then the carcinoma removed.

In some cases it may be necessary to empty the uterus by cesarean section as a first step in the main operation. In infected cases hysterectomy may be chosen.

In general the writer urges that the least operative procedure which will meet the needs of the case, and the one that can be performed in the shortest time, should be selected. The uterus should be disturbed as little as possible. The occurrence of abortion or premature labor after an operation for an acute abdominal condition, greatly complicates the situation because of the development or spread of infection.

As regards the case narrated by the writer where hepatic complications developed during pregnancy, followed by a fatal termination, and where operation found no gall-stones but bile flowed after the operation, the reviewer had a somewhat similar experience. A young Italian primigravida was in advanced pregnancy with increasing toxemia. Medical treatment failed to relieve or control the condition. There was no dilatation of the cervix and there was vague tenderness over the right abdomen suggesting cholecystitis or appendicitis or both. Jaundice was present, and after weighing the possible results of induced labor and other procedures, the patient was delivered by abdominal cesarean section with the birth of a living child, and after the uterus had been closed and replaced, the appendix, which was acutely inflamed, was removed and the gall-bladder drained. There was some accumulated material in the gall-bladder and a beginning cholecystitis. On the following day the discharge of bile through the drainage tube became free, the patient's toxemic symptoms subsided, and mother and child made a good recovery.

Purpura Hæmorrhagica.—This rare condition in pregnancy is described by Hottenstein and Klingman in the March, 1927, number of the *American Journal of Obstetrics.*

Examination of the literature shows that idiopathic purpura hæmorrhagica is rare, as Rushmore found but some 40 cases in a review of the literature. The patient was an American aged 30 with no history of abnormal condition of the blood. Three years before an abortion was followed by peritonitis, a previous pregnancy terminated normally. At her first labor, eighteen months previously, there was profuse postpartum hemorrhage but no purpura. During the pregnancy in which she came under observation, she had some temperature with patches of petechia and hemorrhages into the mouth. The blood disturbance increased steadily after delivery. There was a septic temperature with profuse lochia, and splenectomy was performed but was unsuccessful. An autopsy could not be obtained.

The purpura appeared during the fourth month of the pregnancy, the spots increasing in number and size as the pregnancy proceeded. At this time the blood showed 1,936,000 reds, 2350 whites, 25,000 platelets. Hemoglobin 36 per cent. The clotting time was four minutes and the blood calcium 9.6 Mg.

per 100 c.c. The Wassermann reaction was negative. The urine normal. The patient was admitted to hospital and given a transfusion of 600 c.c. of unmodified blood. This was followed by improvement, but the patient declined to remain in the hospital for further treatment. When she next came to the dispensary four weeks later, she was very weak and the purpura had become general. She finally entered the hospital six weeks later because her gums were bleeding profusely. The purpura was over the entire body, transfusion was again performed. When labor came on she was easily delivered by forceps and the third stage presented no more bleeding than normal. Urine taken by catheter showed a trace of albumin, red blood-cells, and granular casts. The child was a normal male requiring no resuscitation, and although it was artificially fed, has developed normally. The mother's lochia was profuse and she developed a septic temperature and complained at times of blindness. During the week following her delivery she lost considerable weight, she was very anemic and had high temperature. There were retinal hemorrhages and transfusions were again given. On splenectomy the spleen was found not to be enlarged, cultures made from it showed a short chain streptococcus. A blood-culture taken just before the operation was negative. Transfusion was done just before the operation but the patient died on the second day, with great restlessness and difficult breathing.

Autopsy showed generalized subcutaneous hemorrhages. There was edema with congestion of the brain. In the lungs congestion and edema with multiple hemorrhage were present. There were petechial hemorrhages in various organs of the body and an acute parenchymatous degeneration of the kidney, with hemorrhage.

That the case reported was undoubtedly septic, there can be scarcely a doubt. Those who have seen many cases of puerperal septic infection will recall some in which petechial hemorrhages were a very prominent symptom.

In one case the reviewer examined a case supposed to be cerebrospinal meningitis which proved, however, to be septic infection and no evidence of meningitis was found. In another case a diagnosis of hemorrhagic smallpox had been made, but on close examination of the patient, this also proved to be puerperal sepsis. In this instance the case was complicated by an acute syphilis.

Concealed Accidental Hemorrhage.—In the *Edinburgh Medical Journal*, 1926, Proceedings of the Edinburgh Obstetrical Society, Hewitt describes the condition of the uterine wall in concealed accidental hemorrhage complicating pregnancy. He believes that the retention of fluid in the uterus is caused and maintained by painful tetanic contractions of the uterus. The difficulty experienced in making out the fetal parts by abdominal palpation is not due to the presence of blood-clots and placenta between the examining fingers and fetus, but to the tonic condition of the uterus. Examination shows that the membranes are very tense. Sustained spasm of the uterus causes the pain and the cramplike uterine contractions prevent labor from developing.

Cameron (*ibid.*) has found that in concealed accidental hemorrhage many

patients die from shock. He questions whether death ever results from bleeding only. He does not use rupture of the membranes, abdominal binder and packing of the vagina to stop hemorrhage. He demonstrates the fact that no pressure from below, however great, can stop bleeding because the uterine and ovarian arteries anastomose so freely. He relies upon morphin given in doses sufficient to keep the patient in a drowsy condition. When she rallies from shock, 0.5 c.c. pituitrin is given every half hour until labor begins. Should here be any suspicion of uterine rupture, cesarean section and, if necessary, hysterectomy, should be immediately performed.

Rupture of Uterus.—Morvay (*Med. Klin.,* Feb. 1927) in studying this subject finds that rupture of the uterus, whether spontaneous or following trauma during pregnancy or labor, is usually due to some damage to the uterine wall in previous pregnancy, or a previous cesarean section, especially if the uterine incision was high up on the fundus, or if the patient's recovery was complicated by sepsis. Recent curetting sometimes injures the uterine wall and if pregnancy follows soon after, the uterus may rupture at that point. In most cases of spontaneous rupture, the lesions occur in the fundus under an abnormally high placenta. Stretching of the uterine wall over an ovum implanted in the interstitial end of a fallopian tube has also been followed by rupture. In the records of these cases many remain unexplained because it is impossible to get an accurate history of the patient or a histological study of the condition. He cites a case of concealed hemorrhage at the sixth month, in a multipara, where rupture followed very slight trauma, abdominal section was performed two days after symptoms began and a macerated fetus was found in the abdomen, the placenta was adherent to the uterine wall, with old and recent hemorrhage. The uterine tear involved the placental site and was of considerable length. On microscopic study it was found that the fetal trophoblast had penetrated the uterine muscle.

Sudden Death Caused by Manipulation of Pregnant Uterus.—Spilsbury (*Brit. M. J.,* May 14, 1927) states that in most of these cases death occurred during pregnancy and circumstances pointed to attempt to procure abortion. In the majority the method used was the injection of fluid into the uterus, partly separating the membranes. In 2 cases the introduction of instruments into the cervical canal proved immediately fatal; in the third case the instrument had been passed into the body of the uterus. One patient died when a rubber tube, which had been inserted into the cervical canal on the previous day, was removed. In none of these cases was a serious disease found which could account for death, and even microscopial examination failed to reveal cause for the fatal issue.

The writer believes that the emotional state of the patient at the time of the attempt and shock caused by the manipulations produced a reflex vasomotor paralysis resulting in rapid fall in blood-pressure.

Uterine Scar after Cesarean Section.—In a paper by Murray before the Edinburgh Obstetrical Society (*British M. J.,* March 12, 1927), he suggests the terms intraperitoneal and extraperitoneal, for rupture of the uterus. He believes that the chances of rupture of an old cesarean section scar have been

greatly exaggerated. Still, this possibility cannot be ignored and should be kept in mind in pregnancy following cesarean section.

In 50 repeated sections he had found none giving evidence of imminent rupture. In these patients the scar area was thinner than the surrounding tissue, but in all cases tough and firm.

Oligohydramnios.—Schiller and Toll (*Am. J. Obst.*, June, 1927) believe that oligohydramnios is produced before pregnancy by endometritis which is not acute enough to prevent the imbedding of the ovum in the decidua. Through inflammatory hyperemia, one side is nourished more than the other, resulting in unequal development of the fetus, with a long kidney on one side and lack of kidney on the other. An extension of the decidual inflammation to the placenta, chorion and amnion occurs and leads to decrease in the secretion of the amniotic fluid. At early pregnancy malformations such as club-feet are produced.

The inflammation of the placenta accounts for the premature delivery.

The amniotic liquid is probably produced by the epithelium of the amnion and also from the fetal urine.

Basal Metabolism in Pregnancy.—Ramos and Schteingart (*Gynec. et obst.*, May, 1927) find that the thyroid gland influences both mother and child during pregnancy and that conception cannot occur without thyroid activity. If hypothyroidism does not prevent conception, the consequent edema of the uterine mucosa prevents pregnancy. Thyroid hypertrophy and hypothyroidism are common in pregnancy. In 61 per cent of the cases studied, basal metabolism was increased with augmented heat production, especially during the latter stage of pregnancy. Where women show a slight hypothyroidism, under normal conditions, the other endocrine glands may compensate for this by increased activity. This would account for a normal metabolic index seen in some cases during the latter part of pregnancy. The fact that these patients had a lessened quantity of protein has something to do with it. An increased heat output is necessary for the development of the child.

Significance of Enlargement of the Thyroid.—This subject has been studied by Hinton (*Am. J. Obst.*, Feb. 1927) who uses the classification of Plummer in dividing the goiters found among his patients. The most frequent sort of goiter in pregnancy is the colloid. This results from the fact that the thyroid gland cannot meet the excessive demand which pregnancy makes upon it and colloid is secreted in the acini; this is retained, producing distention and a soft and uniform enlargement throughout the whole gland. The patient's pulse is not affected and hyperthyroidism is never present. This condition can be successfully treated by giving thyroid extract ½ Gr. three times daily for three weeks out of each month. Should this dose not be sufficient, it may be increased to from 6 to 9 Gr. daily, but the treatment should be intermittent and not continued indefinitely.

In patients who have had several children, adenomata of the thyroid are seen and especially if the pregnancies have occurred in rapid succession. There is usually a definite mass confined to one lobe, occasionally to the isthmus, which gives the neck an enlarged appearance upon one side. On palpation the

growth is readily made out. It is important to distinguish between an adenoma and colloid goiter. Treatment of the former with iodin or thyroid extract may lessen the swelling of the neck, but the condition cannot be cured, and the danger is that hyperthyroidism may result. If the patient's basal metabolism is normal, no medication should be given; where hyperthyroidism is developing with the existing adenoma, 3 Gr. of ovarian substance and 2 Gr. of pancreatic, may be given three times daily.

Exophthalmic goiter is not common in pregnancy. In considering the treatment of the case the severity of the disease and the duration of the pregnancy must be considered. Where the disease is severe and the patient in the early months of pregnancy, a therapeutic abortion should be produced. If the patient has reached the fifth or sixth month, with little disturbance, she can usually go safely to term. If she is in the later months of pregnancy and very ill, the superior thyroid arteries may be tied and medical treatment given. It is occasionally necessary to perform a thyroidectomy.

In the cases of colloid goiter, iodin or thyroid extract should be used and with judicious management, the prognosis of such a case is good. Apparently the adenomata have their origin during embryonal life, probably from the lack of iodin in the mother. The proper treatment of the mother should prevent fetal adenoma. If adenomata can be prevented, malignant disease of the thyroid will be greatly lessened, for most of these tumors began in adenomata.

Iodin and thyroid extract are contra-indicated where the goiter is caused by adenoma. In exophthalmic goiter, iodin should not be used unless as a preoperative measure to reduce the toxicity of the patient.

In the *Journal of the American Medical Association,* 1926, 87: 1004, C. H. Davis reports his examination of 520 women during early pregnancy, finding 41 per cent with visible enlargement of the thyroid. Within fourteen months after delivery, 8 of these returned with the characteristic symptoms of toxic goiter. During pregnancy several doses of iodin were given, after delivery none. Hyperthyroidism developed in no case earlier than four months after delivery. The usual cause is overwork, worry and nervous strain which produces enlargement of the thyroid in pregnant women.

Women who live in goiter districts should have iodin during pregnancy as a prophylactic measure, unless they have an adenoma of the thyroid. Hyperthyroidism may be developed, but has not yet been observed. The average metabolic rate in 9 women with normal thyroid at term was + 2.4 per cent; after delivery their average was — 1.3 per cent. Seven patients with simple hyperthyroidism had + 22.1 per cent before term with a drop later on to + 3.1 per cent. In the hyperthyroidism group, 9 women had + 32.2 per cent before delivery and eleven days afterward + 8.9 per cent, excepting two. In this last group small doses of iodin were given to these women during the last months of pregnancy. Where patients have been operated upon for toxic goiter and become pregnant later, they are benefited by small doses of iodin; only one such patient could not tolerate the drug.

In one case of toxic adenoma of the thyroid, operation was demanded in the fourth month of pregnancy and later iodin was given. One patient having a

toxic adenoma was apparently benefited by iodin during pregnancy, although her metabolic rate at term was + 86: twenty days after delivery she was successfully operated upon. She continued to nurse the child and additional feedings were stopped six days after the operation. Mother and child subsequently did well. One case of exophthalmic goiter suffered from prolonged nausea and vomiting; ten days before her delivery her metabolic rate was + 81 per cent. She was benefited by the use of iodin. As a rule, patients toxic in pregnancy had a low metabolic reading and some of them had lower readings than those with high blood-pressure, albumin and casts but no edema.

When a comparative study of the amount of calcium in the blood and the function of the thyroid was made, as indicated by the basal metabolism, no relation could be shown between the milligrams of calcium in each 100 c.c. of serum and the metabolic rate. The average metabolism for the patient with thyroid hypertrophy is slightly higher than for the women with normal thyroid, but the series is too small to justify conclusions.

After delivery, 3 patients with toxemia of pregnancy had a lower calcium content: normal patients usually show an increase within eleven days. The administration of cod-liver oil and ultraviolet radiation did not increase the blood calcium.

This preliminary study suggests that if a woman with a normal thyroid has sufficient iodin during the course of normal pregnancy, her basal metabolic rate remains within normal limits, with a slight increase toward the end of pregnancy. Where the metabolic rate is considerably above normal, abnormal function of the thyroid, usually slight in degree, is present. When within eleven days after delivery there is return to normal this must be considered as the average, but it does not prove that increase of rate did not signify abnormality. Such patients require prolonged medical care after delivery. Many cases of confirmed nervous diseases frequently originated in a disturbance of thyroid function during pregnancy.

Graves' Disease.—Fabre (*Bull. Soc. d'obst. et de gynéc. de Par.*, Nov. 1926) describes Graves' disease, presenting continued tachycardia with violent exacerbations, tremors, exophthalmos and a small goiter. Treatment by radium was refused by the patient and accordingly hemato-ethyroidin was given in progressive doses. The patient was better following this, but six months later a nervous disturbance caused a relapse. In the next month the patient became pregnant and all treatment was stopped. In spite of the pregnancy the symptoms did not return, the mental and physical condition of the patient remaining excellent; pregnancy followed a normal course and the patient was delivered of a healthy child and made a normal recovery, nursing her child.

With others, the writer is inclined to believe that in some cases of Graves' and Basedow's disease, pregnancy is actually beneficial.

Pregnancy Following Inversion of the Uterus.—Miller (*Am. J. Obst.*, March, 1927) has studied 55 cases from the literature of this subject and, although a careful search was made, no more reported cases could be found,

from which it is inferred that the accident must be often attended with slight results and therefore escape report.

His case was that of a woman aged 23, who stated that her child had been born about seven months previously, that there was difficulty in delivering the placenta followed by complete inversion of the uterus. There was profuse hemorrhage and the patient's condition was serious for several days. She gradually improved but there was a continuous bloody discharge, occasionally profuse, a dragging sensation in the pelvis and frequent headaches. On examination the fundus could not be felt in its normal location but was protruding from the cervical rim. The patient was successfully operated upon and made a good convalescence.

During the next year she was examined at times and came to the hospital for her next confinement. The labor was carefully watched and was perfectly normal, lasting five and one-half hours, with the birth of a normal male child weighing a little over 6 pounds. Examination of the cervix and uterus following the confinement showed no evidence of the former operation. The anterior uterine wall and cervix were normal and no thin area in the uterus could be found. This examination was repeated two weeks later with the same result, the patient making a complete recovery. The operation performed was what the writer called a slightly modified Spinelli operation.

The youngest recorded case found by the writer was age 18, the inversion was cured by operation after existing for six weeks, and the patient had two normal pregnancies afterward. The oldest patient whose history was found was 37 and inversion in that case was cured by operation after eleven months standing. This patient had one normal confinement subsequently. There were slightly more multiparæ than primiparæ in the histories found, and the average duration of the inversion before operation was thirty-three days. The longest interval elapsing between inversion and its cure was twelve months. This was corrected manually. There were some cases of spontaneous correction, the average existence of the condition being thirty-two months. In several of these cases the spontaneous replacement happened after other methods had been tried. Twenty-two of these patients were operated, on an average of nine months after the occurrence of the inversion, the time varying from five years to four days.

As regards the method of correcting the condition, in 25 the cure was made by manual correction, in 8 the cure was spontaneous and there were 22 operations. One of these patients, after the original inversion, had five pregnancies without a recurrence of the accident. Where the cure was spontaneous two patients had a return of the inversion with a subsequent pregnancy. In the manually corrected cases 44 per cent had a recurrence afterward. There was no recurrence in the cases treated by operation. In the 56 cases there were three abortions and in 38 per cent the placenta was adherent in the following confinement. The occurrence of adherence of the placenta was much more frequent where cases were treated manually than after operation. In 42 cases the final result of the condition was described and among these there were two cases of sepsis, one of whom died. This patient had been

cured of her original inversion by operation three days previously. The other septic case recovered. There was no case of rupture of the uterus.

So far as the treatment, in labor, of these cases is concerned, while precaution should be taken to give prompt treatment by operation if necessary, the patient should be given the opportunity of spontaneous confinement. It would seem that cesarean section was indicated more in cases that had been treated by manual reduction than by operation.

Uterine Myoma.—Ferguson (*Brit. M. J.*, March 12, 1927) reports 2 cases of this condition.

The first, a primipara, when first seen had a tender lump in the left side of the abdomen, the uterus pushed to the right. This apparent tumor was freely movable away from the uterus. The patient had pain and slight elevation of temperature. The attending physician thought that the tumor had increased in size within a week and that in the first weeks of pregnancy he had found no tumor. Although the history showed that the pregnancy could not be more than four and one-half months, the fundus of the uterus was above the umbilicus; neither fetal movements nor heart sounds could be detected.

At operation, a subserous fibroid was found on the left anterolateral surface of the uterus, attached by a broad base, and easily removed from its capsule. A very small fibroid was allowed to remain, the patient made an uninterrupted recovery and the pregnancy went on normally.

The second case was that of a negro multipara at full term, brought to hospital with the history that following the escape of amniotic liquid, a fetal foot had come down. There was slight fever and a foul-smelling vaginal discharge; there were no uterine contractions and the examination resulted in the provisional diagnosis of twin pregnancy, although no fetal heart sounds could be heard. Two swellings resembling fetal heads could be made out. The cervix admitted three fingers and two macerated legs were brought down. It was impossible to empty the uterus, but two hours later a decapitated body of a fetus was spontaneously discharged. On the following day a foul and macerated head was delivered. The placenta was manually removed with great difficulty, and a large fibroid found. The patient died from shock and septic infection.

At autopsy a large fibroid occupied the entire left wall of the uterus, the size of a full-term pregnancy. There was no history of such a tumor before the pregnancy and it must have grown very rapidly.

Evidently this patient's chance of recovery was lost when she was not in hospital at the beginning of labor.

Whooping-Cough.—In the *Wiener klinische Wochenschrift*, February 17, 1927, Goldschmied states that in 187 cases of whooping-cough reported by Heubner, there were only three adult patients.

Whooping-cough in pregnancy is very rare; hemorrhage and abortion do not often occur, but occasionally the violence of coughing may rupture the membranes prematurely. In the puerperal period pneumonia is likely to arise.

The writer's case was aged 38 in her second pregnancy and contracted whooping-cough in the last month of pregnancy, giving birth to a healthy child

one and one-half weeks before term. During labor there were violent paroxysms of coughing and the labor was somewhat precipitate. The child was kept away from the mother for five weeks, being fed upon breast milk taken with the breast-pump. It escaped the disease. Cases of whooping-cough in the newborn have, however, been reported.

Early Operation Indicated in Appendicitis.—Portes and Seguy (*Gynéc. et obst.*, Feb. 1927) do not believe that pregnant women are especially liable to acute appendicitis, but they are convinced that pregnancy very often causes a chronic appendicitis to become acute. Half of the cases of acute appendicitis during pregnancy are recurrences.

A woman having had appendicitis and contemplating marriage should have the appendix removed before marriage. When appendicitis complicates pregnancy, there does not seem to be more tendency to peritonitis than in the non-pregnant; but when a woman who has had appendicitis has a return which develops during labor, then peritonitis is frequent. The dangers during labor for these patients are so great that the appendix should be removed in pregnancy as soon as the diagnosis of appendicitis can be made.

Mental Disorders and Eugenics.—The Galton Lecture of the year 1927 was given by Tredgold on "Mental Disorders and Eugenics" (*Brit. M. J.*, Feb. 26, 1927). The speaker said that evolution in the human subject had proceeded mainly in the sphere of mind and would probably continue in the same direction. Progressive evolution depended upon vitality and mental capacity, and hence the importance of mental diseases on the aspect of eugenics. One should carefully distinguish between mental diseases and eccentricity. Eccentric persons were not inefficient nor were they lacking in aptitude; many were pioneers of thought and most valuable members of society. Mental diseases might take the form of defect, disorder or decay, all of them due to the failure of the organism to adapt itself to its environment. These three forms were usually but different manifestations of one and the same cause, and a great majority resulted from inheritance. While inheritance might play a great part in insanity and mental breakdown, the main cause was constitutional; even in shell-shocked cases, there was a definite predisposition to mental breakdown.

Inheritance is not of the disease itself, but of the neuropathic diathesis which results from the devitalization of the germ-cell. As the individual results from the union of two germ-cells, the condition of one of these cells may have very different results upon the offspring. What is inherited is a tendency for development to proceed in certain directions, and due to a certain limit in deficient germ-cells and inheritance; the result was mental deficiency in some cases, in others dementia; in others the individual might go through life apparently normal, but with an impairment which might reveal itself in mental disease in a subsequent generation. The attempt to show that mental disease or defect is transmitted in accordance with mendelian law has failed. When one of the combining cells is healthy, the reduction in vitality is lessened; such an individual might show a normal mentality, but always be liable to mental

breakdown under stress. Inherited impairment may be neutralized or even bred out if detected early in life.

Mental disease in a community is kept alive by carriers, those who are apparently normal but who break down on exposure to stress.

The writer found no evidence of close association between genius and insanity, the great majority of men of genius had seemed to him to have been remarkably sound. Mental disease is, however, closely associated with social inefficiency and retrogression.

Danger to the race lies in the contamination of sound and healthy stock by those predisposed to disease. What is urgently needed is the prevention of propagation by those persons suffering from disease due to inheritance. He believes segregation to be better than sterilization and an intensive educational campaign he thought might be of value.

Meningitis.—In the *British Medical Journal,* February 19, 1927, MacQueen describes 2 cases of meningitis complicating pregnancy. The first was a multipara aged 26, who for a week before coming to the hospital had severe headache, and just before admission a commencing left-sided facial palsy. The patient was at full term but not in labor. The pupils were dilated, the reaction to light lost. There was slight but definite paresis of the left side of the face, and some loss of power in the left arm. The usual symptoms of meningitis were absent. The temperature was 102.6° F., respirations 44, pulse 124. A specimen of urine, obtained by catheter, measured 18 ounces, was acid, yellow, clear with a faint trace of albumin.

On lumbar puncture the cerebrospinal fluid was very cloudy with the pneumococcus in pure culture. Five hours after admission, quinin was given, the os dilated manually and a living child extracted by forceps. The death of the mother followed five hours later.

At autopsy the surface of the cerebrum was covered by thick greenish pus, the pleuræ were adherent to the chest wall at both apices and the lungs were congested but there was no consolidation or cavity. The child lived for several weeks and died of acute enteritis.

The second case was a multipara aged 36, admitted with the history of otorrhea for several years. She was seven months pregnant and had been well until five hours before admission, when she had two convulsions and became comatose and delirious. On examination the temperature was subnormal, the pulse 110 and irregular. The patient was restless and noisy. The pupils were unequal and reacted to light, reflexes exaggerated and marked retraction of the neck. Later on the urine was normal. From the right ear there was a discharge. On lumbar puncture the cerebrospinal fluid was purulent and so thick that it could only drop slowly from the needle. The patient died thirty-six hours after admission and cesarean section was performed three minutes after death was certain, and a living child weighing 4 pounds was removed.

At autopsy the surface of the cerebrum and medulla and pons and the surface of the temporosphenoidal lobe and insula were covered by a thick layer of greenish pus. The left middle ear was the source of infection. There

was no sign of definite cerebral abscess. The organism present was the pneumococcus.

Medical Aspects of the Maternal Instinct.—In the *British Medical Journal,* April 2, 1927, Casson reports a study of instinctive behavior regarding the maternal instinct. In this she believes that there are three processes in every reaction occurring in the nervous system—stimulus, appreciation, and action or strong impulse to action. Emotion is the usual manifestation of appreciation. There is considerable difference in the stimulus and resulting action in various individuals, but emotion, for example, of fear is unmistakable. The specific emotion of the maternal instinct was a yearning to cherish. For this there is no one term, but when in a cinema attendance, a child suddenly appears on the screen, a considerable number of women in the audience give expression to an inarticulate sound. To a physician a patient with mental disorder is practically a child exciting the parental instinct, and this accounts for the resentment often felt by doctors at the slightest interference with the treatment ordered. Suggestions to parents regarding the training of their children are often greatly resented.

It would be interesting to note at what age maternal instinct appears, what is its physical basis, its abnormalities, its relation to infanticide, its absence in advanced states of dementia. Among patients suffering from mental disease, one of the first signs of recovery is often the return of affection or pity for other patients or for nurses. In treating cases of mental disease in a hospital it is not easy to secure suitable stimuli for the maternal instinct. There are few infants in such hospitals and, with the exception of other patients or nurses, no one to call forth such instinct. The best substitutes are dogs and cats and patients sometimes have great comfort in them. Other mental cases find relief in crafts and occupational therapy. This substituted maternal instinct may become abnormal, as in those who keep large numbers of animals or are violent in their opposition to vivisection. Sometimes a patient who has lost a child will transfer to herself the care and attention which the child had been receiving. Among mental cases one might find an old demented patient caring for and nursing a pillow, and occasionally these patients become quiet if given a doll for which they may care.

The writer urges the importance of studying the primitive instincts. In mothers mentally deranged, warning of their possible action in destroying the child might be obtained if derangement in their instincts of sleep and taking food were early apprehended. Where patients are discontented and depressed, it is often well to investigate the matter of repressed or absent maternal instinct; such patients are often benefited by doing charitable work, as during the War, but it was observed that when this stimulus was removed they often collapsed. The adoption of a child, teaching, nursing, infant-welfare work, or any occupation which excites all the energies of the patient, might be beneficial.

Hypertension in Pregnancy.—Stieglitz (*Arch. Int. Med.,* April, 1927) studied the relation of the calcium content of the blood with the hypertension of pregnancy. One group were relatively benign, occurring in early pregnancy with gradual rise of tension and little serious intoxication. He observed a

later malignant type with sudden tension and intoxication, which may proceed to eclampsia. Another group of cases who had preëxisting vascular and renal disease, showed hypertension in pregnancy. Others had definite complications such as toxic goiter, cardiac disease and acute infection.

From his observations he concludes that hypocalcemia is not an important factor in arterial hypertension in pregnancy. During the last month of pregnancy tension and calcium content rise gradually.

Heart Disease.—Emanuel (*Brit. M. J.*, March 26, 1927) draws attention to the great difference between the mortality rates of heart disease complicating pregnancy as stated by different observers. This varies from 3 to 60 per cent.

Most likely to affect the heart in the childbearing age is rheumatic disease of the heart, and mitral stenosis, with or without aortic disease, is the most common form. About 1 per cent of pregnant women suffer from rheumatic heart disease. The cardiac output in cubic centimeters per minute during pregnancy has been found in animals to be increased by one-third to one-half the output before pregnancy. The normal heart can meet this extra load, but a damaged heart is liable to fail. In normal pregnancy there is no evidence of a heart hypertrophy or that blood-pressure is increased. It is impossible to estimate mathematically the reserve power of the heart. In the pregnant patient, often an intercurrent infection, such as a common cold, influenza, endocarditis, auricular fibrillation, embolism, difficult labor, sepsis and the toxemias of pregnancy, will ruin a previously damaged heart. In prognosis the study of the rhythm and the size of the heart are the most important guides. Auricular fibrillation should be a bar to pregnancy. When the heart is not enlarged, mitral disease produces but little additional risk, but the risk increases as the enlargement of the heart increases.

If one is asked to give an opinion regarding the safety of pregnancy in a woman with disease of the heart, it is exceedingly difficult accurately to do so. If the patient has ever had signs of cardiac failure, pregnancy must be avoided. Where signs of cardiac failure develop during pregnancy, the same methods of treatment as those employed in the non-pregnant are indicated; emptying the uterus does no good, for cardiac failure sometimes develops after labor. The physician should first overcome the cardiac failure before interference with pregnancy is considered. The period of gestation, the financial condition of the patient and her ability tc obey instructions are important factors in such a decision. When cardiac failure occurs early in pregnancy, abortion is required, but in the later months, under strict supervision and treatment, a living child may be obtained by cesarean section followed by sterilization.

In discussion it was urged that with a defective cardiac condition in pregnancy, the simplest method of combining evacuation and sterilization lay in supravaginal hysterectomy with preservation of the ovaries.

The majority of those who took part in the discussion urged the induction of abortion in early pregnancy when heart-failure was threatened, and cesarean section and sterilization in later pregnancy.

In this connection, the reviewer calls attention to the value of local anes-

thesia in the performance of cesarean section in patients with diseased hearts. With the preliminary use of morphia with or without scopolamin, and infiltration of the tissues with novocain, little difficulty is experienced in performing cesarean section, followed by the complete removal of the fallopian tubes. This disturbs the patient as little as possible, leaving her in a favorable condition of general health. In comparison with other methods of treatment this is at present remarkably successful.

In the *Archives des maladies du cœur, des vaisseaux et du sang,* December, 1926, Doumer reported observing pulmonary edema, acute and dangerous in pregnant women, with mitral stenosis. Aside from pregnancy, this rarely happens, but he believes that these attacks are more common than ordinarily reported. His patient had a bad stenosis with a moderate auricular dilatation, and this would seem to show that the usual theory that hypertension is a dominant factor in causing pulmonary edema, is incorrect. Even with mitral stenosis, pulmonary edema may occur without stasis or hypertension. In nonpregnant patients, pulmonary edema, due to mitral stenosis, often results from a second infection, especially the lighting up of articular rheumatism. Among pregnant patients this is not observed, contrary to all ordinary expectations. In one of his pregnant patients a preëxisting acute pulmonary edema complicating mitral stenosis, disappeared during the pregnancy. This the writer believes results from the fact that the pregnancy completed the dilatation of the already dilated auricle, thus causing the edema to disappear. He does not believe it necessary to consider pregnancy the cause for pulmonary edema in order to explain some crisis or edema in mitral lesions; he considers pregnancy as only a factor in dilatation of the heart.

Hamilton and Kellogg (*Am. J. Obst.,* April, 1927), by studying the statistics of heart disease complicating pregnancy, found that in decompensated cases the maternal mortality was 45 per cent. The work of the prenatal clinics had so far helped little in lessening this mortality. The plan was then tried of grouping certain cases representing the more prominent obstetric problems in special service, and assigning each group to different doctors of the staff for intensive study during periods of the year. In one of these groups were cases complicated by heart disease. This resulted in the formation of practically cardiac clinics in connection with the usual prenatal clinics. In the last five years 882 patients have passed through this clinic or come to the hospital as emergencies; they all were observed by cardiologists, and they were supposed to have heart disease when sent to the hospital. Of the 882 cases, 218, about 25 per cent, had true cardiac disease, most of them rheumatic in origin.

In the whole pregnancy clinic 7.5 per cent of patients had something in the history or physical examination suggesting possible disease of the heart. There was one group giving no true evidence of heart disease but having breathlessness, rapid heart, pain, fainting and giddiness, which were produced by cardiac neurosis. These patients usually do well without especial treatment other than encouragement and hygiene. Another group of patients had systolic murmurs, possible enlargement, third heart sounds or extrasystoles. It

is impossible to say certainly that they have no cardiac disease. If these patients are treated symptomatically, they usually do well.

From 1 to 2 per cent of all pregnant cases have significant heart disease. A small number have cardiovascular syphilis, congenital heart lesions or disorders of the heart body. The greatest number of pregnant patients with genuine heart disease have rheumatic heart disease with mitral stenosis or aortic regurgitation or both. They contracted the disease in childhood and adolescence and have grown successfully to adult life. These patients require careful attention during pregnancy.

If a patient with a serious heart condition asks concerning the risk of pregnancy, she must be told that the death rate of such patients during pregnancy or the puerperal period is about 5 per cent. There is the risk of 10 per cent that the child will not be living at the end of her pregnancy. Whether she will recover in comfortable health cannot be foretold. To keep the risk as low as the figures stated she must follow explicitly the rules of rest through pregnancy, go to the hospital at once if failure develops, consent to the interruption of pregnancy on indications. Under some conditions she should be advised against pregnancy.

The patient who has had clear signs of congestive failure should have the pregnancy early interrupted. So should one who has nephritis, hypertension, auricular fibrillation or absolute disorder of the heart body. The same advice should be given to patients suffering from rheumatic fever or who have recently had rheumatism. The risk of such patients surviving the pregnancy is too great to be justifiable. Where such cases are seen in mid or late pregnancy, the patient should be given prolonged rest in hospital under medical treatment with the hope of securing a viable child. Unless under such treatment decompensation grows much less, the pregnancy must be interrupted. There can be no exception to the rule, but if the patient with heart disease develops decompensation during pregnancy, she must remain in hospital until the pregnancy is terminated.

The indications for sterilization following delivery are the same as those for interrupting pregnancy. If the patient knowing the risk of pregnancy requests sterilization, this should be done. The fact that such a patient has survived one or more pregnancies is no proof that the next may not end fatally. It is interesting to observe that many of the most alarming signs and symptoms complained of by these patients are not followed by serious consequences. Careful observation and medical care have lessened the necessity for the interruption of pregnancy. When a pregnant patient has previously been well and decompensation develops, it is usually the result of disobedience of rules of control of activity, or intercurrent disease which cannot be foreseen or prevented, and occasionally from a sudden cardiac infection such as auricular fibrillation, which cannot be predicted. Decompensation in these cases often develops about the sixth month and may proceed in spite of rest and treatment, it may also continue after an uncomplicated delivery.

The writers have not found that cardiac pregnant patients have easy deliveries or that they miscarry if decompensation occurs.

As regards cesarean section in these cases, the writers believe ether, very carefully given by the open drop method, is the best anesthetic. They think that they have seen scopolamin do harm. Under ether anesthesia the length of time necessary for cesarean operation is greatly reduced; often scopolamin excites a cardiac case and it is necessary to resort to general anesthesia and cardiac failure and death may result. When multiparous cardiac patients can be delivered by forceps when dilatation is fully complete, sterilization may be done to advantage some months later. The cesarean operation should not be done for the sake of sterilization.

The writers believe that many primiparous cardiac patients who have gone to full term without decompensation can pass safely through the first stage of labor under the common analgesics and be delivered with full dilatation with forceps under ether, more safely than by section.

Dressler (*Wien. Arch. f. inn. Med.*, March 15, 1927) finds that auricular fibrilization is a grave complication of pregnancy, especially when associated with mitral stenosis. He describes two primiparæ having the symptoms of serious heart-block but passing through pregnancy and labor without accident. The first, aged 35, had frequent syncopal attacks; she had had symptoms of a heart-block for twenty years. The other had frequent attacks of syncope after influenza five years previously. Her confinement and puerperal period were normal, but when discharged from the hospital an electrocardiogram showed complete heart-block.

Another case collected from the literature is that of a woman with mitral regurgitation who had syncopal attacks and died in eclampsia. Autopsy showed old and serious heart lesions.

The writer believes that a pregnant patient showing even slight symptoms of the interruption of the bundle of His should be kept under most careful observation; if myocardial disease becomes extensive, parturition must be avoided and if possible pregnancy. Heart-block may not produce perceptible reduction in the function of the heart and partial heart-block does not therefore necessarily forbid pregnancy, if the patient is kept under observation.

The development of serious symptoms calls for the interruption of pregnancy.

At a meeting of the British Medical Association, Monroe Kerr (*Brit. M. J.*, Aug. 13, 1927) contributed a paper upon cardiac disease complicating pregnancy. He draws attention to the fact that cardiac hypertrophy is normal during pregnancy and that it is associated with dilatation of the heart in about 60 per cent of the cases. Little information is to be gained by percussion except in gross cardiac enlargement. The heart is displaced during pregnancy, upward and backward, the apex beat being often felt in the fourth interspace with the left margin of dulness displaced.

In normal pregnancy there is no increase in blood-pressure, but in pathological conditions the pressure is greatly altered; in the latter weeks the pulse rate is very easily disturbed. There is also increase in body weight, blood volume and cardiac output which affect the action of the heart.

Functional disturbances in pregnancy are not uncommon, and are often

mechanical, while at other times they arise from disturbed innervation, alteration in metabolism or overaction of the thyroid gland. The condition of the heart muscle determines the seriousness of a heart condition complicating pregnancy.

In the Royal Maternity Hospital in Glasgow the mortality of pregnant women from heart disease is between 15 and 25 per cent. The methods of delivery were varied in these cases. Among these, 6 patients were delivered by cesarean section, all of whom recovered; a hysterectomy at the third month also recovered. Of the cases that died, 2 were spontaneously delivered, 2 had induction of labor, 3 died undelivered.

Evidences of approaching danger to these patients are: difficulty in breathing with evidence of pulmonary congestion, alterations in the urine and in blood-pressure. Aortic regurgitation is comparatively rare, occurring in 4.7 per cent; when decompensation occurs, the condition is very serious.

Mitral regurgitation is common with a mortality of 7.8 per cent in simple mitral regurgitation, contrasting with 24.5 per cent for mitral stenosis.

As regards treatment, the mistake is commonly made of delaying obstetric treatment too long. When a physician diagnosticates cardiac disease complicating pregnancy, the aid of the obstetrician should immediately be sought.

In some cases the artificial termination of pregnancy is the immediate cause of the patient's death. It has been too long delayed and a suitable method is not employed. In terminating pregnancy, great caution should be taken to avoid shock. In early pregnancy, rapid dilatation of the uterus may cause severe shock and hence a more gradual method should be employed. This is often dangerous, so that the writer believes that in early pregnancy, vaginal cesarean section should be chosen. In the later weeks rupture of the membranes or the introduction of bougies may be employed. Unfortunately, no one knows when labor will begin and a delay of one or two days, with nervous strain and nagging pains, is greatly to be avoided.

Statistics show a mortality of 44 per cent in one series and 50 per cent in another, from the gradual induction of labor. In contrast to this, cesarean section gives a mortality of 11 per cent, in some series frequently much lower. The operator may also sterilize the patient by excising a portion of the fallopian tubes if it is thought best. The writer believes that forcible dilatation of the cervix, manually or by instruments, must be avoided. In cases of serious cardiac disease, cesarean section, especially in primiparæ, is to be selected.

The writer has not seen danger from the skillful use of chloroform with these patients.

FitzGibbon also contributes a paper giving the results of his observation at the Rotunda Hospital in Dublin. His mortality was 22.7 per cent and the frequency of these cases with modern methods of examination is 0.33 per cent. In prognosis he has found that when decompensation occurs in labor only, the prognosis is good. If decompensation occurs in pregnancy and is treated promptly, the prognosis is good, but a neglected decompensation receiving no attention until labor begins, has a bad prognosis. Multiparæ often

give a higher mortality rate than primiparæ, and the chance of recovery is better in women under 25 than those over 30.

Decompensation does not usually develop until the second half of pregnancy, but the greater the number of pregnancies, the earlier in the second half will it occur. Over 75 per cent of primigravidæ with compensated heart lesions go to term, but one-third of these develop failure as a result of labor, but they usually deliver themselves of living children and recover. If compensation fails in primigravidæ during pregnancy, it can usually be established and labor is usually successful. In multiparæ only about 50 per cent go to term and they are more apt to develop failure during labor. With them it is difficult to reëstablish compensation during pregnancy. The danger is that compensation will be lost.

As regards treatment, both primigravidæ and multiparæ who have had no failure in heart action during pregnancy may be allowed to go through pregnancy and labor, with especial care during the last eight and sixteen weeks respectively.

If decompensation occurs during pregnancy, the cardiac function must be reëstablished and the patient kept at rest until after delivery. Primigravidæ may be allowed to go through labor, but multiparæ will probably be delivered most safely by section at the thirty-sixth week, and should be sterilized.

In a multipara, if decompensation occurs before the thirtieth week, the cardiac state should be reëstablished and the pregnancy terminated, as there is very little chance of the fetus surviving. Labor must be shortened in cardiac cases, with the avoidance of shock.

A patient who has had decompensation during labor in a previous pregnancy, should be kept at rest from the twenty-fourth week of the next and this pregnancy should be terminated by section and sterilization.

Induction of labor has no place in the management of decompensation, and at other times it should be replaced by section and sterilization. In his experience there is little to choose between the various types of cardiac diseases, as regards the results for the patient.

In the *British Medical Journal,* April 16, 1927, Oliver contributed a paper upon the subject of heart disease in pregnancy. He quotes the statistics from a maternity hospital under his observation, where in one year 9 pregnant patients with heart disease were admitted. Three had mitral stenosis, 3 mitral incompetence, one aortic regurtitation and 2 myocardial weakness. All passed through labor successfully and made good recoveries.

In the following year, 16 cardiac cases were admitted, among whom were 3 deaths, one patient who had aortic regurgitation died undelivered, with angina; one was admitted moribund with mitral regurgitation, six and one-half months pregnant, and died undelivered; another also with a mitral regurgitation, died a few hours after admission.

Of 38 cardiac cases, 13 had mitral stenosis, 12 regurgitation, 6 aortic regurgitation; 4 of these, 10.6 per cent died in hospital. He quotes the statistics of a general hospital with a mortality of 11.1 per cent among heart cases.

He calls attention to the fact that in mitral stenosis complicating pregnancy there is possible auricular fibrillation with heart failure.

In attempting to collect statistics it is difficult to obtain statistics of large numbers of cases, for heart disease complicating pregnancy and attaining severity is comparatively rare. The statistics vary from 0.38 per cent of pregnant women as having heart disease to 1.06 per cent. In one series of 8000 pregnancies, 80 patients had heart disease, of whom 14 died. In a case under his observation where the second stage of labor was brief, the great change in blood-pressure following the emptying of the uterus, brought about a fatal cardiac failure.

So far as heart disease as a contra-indication to marriage is concerned, the condition of the heart, the presence or absence of dilatation, regularity and rapidity of heart beat, history of hemoptysis and dyspnea, as well as the social and economic position of the patient and her prospects, must all be considered. Irregularity of the heart's action is an important danger to pregnant women. He quotes Mackenzie's opinion that the condition of the myocardium in the pregnant woman is of more importance than particular valve lesion. Breathlessness and pain, in his opinion, were important symptoms.

During pregnancy, intracardiac conditions may arise which render a heart incapable of carrying the patient through labor and the puerperal period. All types of irregularity are not equally dangerous. The condition of the myocardium is of primary importance and the presence of pulmonary congestion with a diseased right heart is important.

As regards treatment, the pregnant woman requires attention during her pregnancy, parturition and puerperal period. Where there is good compensation and no difficulty in breathing, the proper diet, regular exercise and competent excretion, with rest, will keep the patient in good condition. If the blood-pressure remains average, the chances are that the patient will do well; where, however, toward the end of pregnancy the pulse becomes rapid, feeble and irregular, the case is serious and the patient must be kept in bed and given digitalis in increasing doses if needed. During labor signs of fatigue must be recognized promptly. In the second stage labor must not be allowed to exhaust the patient, and the use of forceps is frequently indicated. For difficult breathing, oxygen, strophanthin, digitalin or strychnia, may be required. After the placenta has been expelled, pressure should be continued over the abdomen. During the puerperal period the patient should be watched to prevent her getting up too soon or from sudden exertion.

Patients with heart disease complicating pregnancy who have no private physicians, should report to antenatal clinics at regular intervals during pregnancy, and enter maternity hospital before term. Such should seek medical advice so soon as the condition of pregnancy is suspected.

Placenta Prævia and Its Management.—In *Surgery, Gynecology and Obstetrics,* January, 1927, Broadhead and Langrock give the result of their observations and treatment in 165 cases of placenta prævia. Their mortality was 18.

In view of the fact that digital examinations often cause hemorrhage, it

was their experience that when placenta prævia was suspected, should a digital examination be made, a firm tampon should be in readiness. If the examination is followed by hemorrhage, this tampon should be immediately and firmly applied.

Of the 18 fatal cases, there were 6 patients already much depleted through bleeding, the cervix admitting two or three fingers, and the writers are inclined to believe that these cases might have been saved by cesarean section. The value of this operation in placenta prævia lies in its rapidity, the avoidance of dilating a bleeding and soft cervix, and the dangers attending extraction following version. As a rule there is little bleeding in cesarean section.

Among these were 22 cases of central placenta prævia at six to eight months, three of which did well with cesarean section, while 19 had version with four deaths. After any method of delivery, the writers urge that the genital tract be tightly packed with iodoform gauze to prevent secondary hemorrhage.

Where it is possible, the blood of the patient should be typed before delivery and arrangements made for direct transfusion if required.

Common Cystic Structures of the Human Placenta.—Paddock and Greer (*Am. J. Obst.*, Feb. 1927) have studied cysts of the placenta in the Department of Obstetrics of the Washington University School of Medicine. They illustrate their paper by the reproduction of microscopic sections.

Their studies lead them to conclude that these cystic bodies have their origin in decidual tissue, and that they result from the action of trophoblastic cells on the tissues of the decidua. The islands of decidual tissue in the placenta are, in origin, maternal, and seem to be portions of decidual septa. Where these cysts are found, white infarction is also present to some degree, and the writers believe that in all probability these cystic structures are the cause of the white infarcts.

They could identify these bodies in 231 cases, both in the gross and microscopic study, and among these patients there were 8 premature deliveries, 11 stillbirths and 5 infant deaths. Where the microscopic structure alone could be demonstrated, in 51 cases, there were one abortion, 3 premature deliveries, 2 stillbirths and 2 infant deaths. These cysts developed in about 14.1 per cent of cases.

The material contained in the cyst is colloid, but its chemical and physiologic nature has not yet been determined. It is interesting to note the condition of the mothers in these cases. In 36 the thyroid was enlarged, and one of these patients had previously had thyroidectomy; there were 8 toxemias and 12 syphilitic cases. Other complications of pregnancy were present in much smaller number.

Causation of Stillbirth and Neonatal Death.—Thomson (*J. Obst. & Gynæc. Brit. Emp.*, 1926, 33 : 390) has analyzed 100 cases of stillbirths and neonatal deaths, regarding their causation. Syphilis accounted for over one-third of the deaths in the cases of macerated stillborn infants. Where maceration was absent, complications of labor, syphilis or fetal deformities and

congenital defects were among the most important causes of fetal death. One-half of the deaths of this group were caused by complications of labor.

In the neonatal cases, 26 in number, lesions in the lung of the child, toxemia of pregnancy, syphilis and prematurity were important.

So far as preventive treatment goes, more may be hoped for from the treatment of toxemia and syphilis than anything else.

In *Surgery, Gynecology and Obstetrics,* April, 1927, Resnik describes a recto-abdominal maneuver for the determination of the engageability of the fetal head. He illustrates this by diagrams and pictures. He determines the position, presentation and posture of the infant and locates the anterior shoulder. The finger is then placed in the rectum to just above the level of the ischial spines. The palm of the other hand is placed flat on the abdomen on its most dependent portion; this is usually in the suprapubic region and as nearly over the anterior shoulder as possible. With this hand this portion of the abdomen is raised upward toward the mother's head, rather forcibly. As this is being done the hand slides slowly upward on the abdomen to a point just above the umbilicus where strong pressure is then exerted toward the mother's back. If the head is engageable it advances into the pelvic inlet, frequently as low as the ischial spines, and one can feel definitely certain that it will engage during the course of labor. The first maneuver releases the head from any impingement and brings the axis of the uterus into parallelism with that of the pelvic canal. The disappearance of asynclitism results in deflection and descent of the head, restoring its parallelism, and the sagittal suture approaches the middle of the pelvis. In the second maneuver the fetus is pushed dorsally toward the mother's back, which straightens its spinal column and causes further descent of the head into the pelvis. This is based on the principle that in the mechanism of labor, as the head descends, the back loses its convexity. In primiparæ with slightly contracted pelves preventing engageability, it is usually necessary to start the first part of this maneuver with the hand in the right or left lower quadrant, approaching the flanks, depending on the location of the dorsum. The hand is placed as near the anterior shoulder as possible, which is usually in the flank in these cases, and the maneuver is proceeded with as before.

This procedure is most valuable in a multipara with a border-line pelvis, a pendulous abdomen or a faultily inclined pelvis causing asynclitism which prevents engagement. It is also valuable in primiparæ with slightly contracted pelvis, occiput posterior position and delayed engagement. The principle of the method is the same as the abdominal binder, but it is believed that it is more efficient than the binder.

Hydatid Mole.—Lodge (*Brit. M. J.,* March 12, 1927), in 37 cases of hydatid mole, found 70 per cent in the third decade of life and only 8 per cent after forty years. Primigravidæ comprised 30 per cent of the patients. In addition to the symptoms usually described, there was a brownish discharge in many of these patients. Severe vomiting and albuminuria were often seen. In all patients the Wassermann reaction was negative. Nineteen of the cases had been followed up and only one of them developed chorionepithelioma.

In studying the records of the various pathological laboratories in Edinburgh, Lodge had found that chorionepithelioma was very rare, but 6 cases having been reported in ten years. From this he infers that after the expulsion of a mole, the uterus should not be immediately curetted, for the results were often bad; later such interference produced little disturbance.

The complications following hydatid mole were sepsis, hemorrhage and the development of malignant disease. Abdominal hysterectomy or vaginal hysterectomy at term were indicated.

The Human Sex Ratio.—Crew (*Brit. M. J.*, April 23, 1927) states that the secondary sex ratio is near equality and constitutes one of the many disharmonies peculiar to the human species. One male in the matter of gamete formation, was the equivalent of many females. The habit of producing offspring has no relation to the social needs of mankind and the reproductive requirements of the present day do not correspond with the ordinary sex ratios.

At the time of conception the primary sex ratio is no less than 170 males to 100 females, but the increased mortality among males makes the disproportion much less.

THE TOXEMIAS OF PREGNANCY

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The general subject of the toxemias of pregnancy continues to occupy professional attention to a large degree. However, since the publication of this volume in 1922, comparatively few noteworthy contributions have been made to medical literature dealing with the etiology and pathology of the several varieties of the toxemias of pregnancy. Certain lines of investigation seem to have been left untouched. Original research in the domain of pathology, for example, has not as yet been extended to the circulatory system or to the endocrins, and the hope may be recorded that the next decade will throw some light on etiological factors based on a possible disturbance in the system of ductless glands. Nor has the nervous system been given the attention which it deserves, for no definite pathologic basis for the irritability, which is such a prominent feature, particularly in the toxemias of the later months of pregnancy, has been discovered. The close association between eclampsia and possible kidney lesions still occupies the center of the stage, but I can add very little to my conception of the subject as detailed in a previous chapter. The fact that toxemias of pregnancy in the later months occur without demonstrable kidney lesions, except a possible insufficiency, shows that we are perhaps inclined to such association by clinical rather than pathologic tests. In this connection attention may be drawn to the concept of this disturbance which has been denominated by Kellogg as a "recurrent toxemia of pregnancy." Kellogg believes that in this particular group of cases of toxemia, the kidney insufficiency is the signal symptom in a recurring pregnancy. It is important to recognize this possible distinction between the class of cases which Kellogg calls by the new term and which I have described under the general title of "nephritic toxemia," because in making such distinction the prognosis can be more definitely determined in the individual case. Kellogg believes that if the condition is recognized, much can be done to avoid future trouble by careful attention to diet, thorough rest, with a minimum of exercise, at least ten hours' sleep every night, and absolute freedom from worry and care. All forms of exercise except moderate walking are interdicted and exposure to wet and cold must be avoided. Kellogg believes that with such care patients may be carried through subsequent pregnancies who have aborted or who have had labor induced for increasing signs of toxemia. I am inclined to agree with this view and have personally observed several instances in which pregnancies have been successfully carried through under this régime and in which no definite evidences of kidney pathology could be elicited.

Uric Acid.—In a study of the uric acid content of amniotic fluid, Williams and Bargen found this as well as creatinin present in appreciable amounts. Although the concentration does not appear to vary in relation to any particular pathologic condition, the highest values were found in the fluid from a case of toxic vomiting. The uric acid was also found to increase with the termination of pregnancy and the highest point (7.73 Mg. per 100 c.c.) was found in a case three weeks overdue, which leads to the supposition that the fetal urine may be a source of the same. Williams and Bargen conclude that the greater concentration of uric acid in the amniotic fluid over that in the blood suggests that in the toxemia of pregnancy the increased uric acid in the blood may arise in part from a more highly saturated amniotic fluid. If this is true, the rapid subsidence of toxic symptoms after rupture of the membranes in many cases may be partially accounted for.

Further studies in the uric acid content of the blood have also been presented by King and Denis, who compared their observation in normal and toxic cases and found that, while their results confirmed those of Williams, Caldwell, and Killian, they were not able to differentiate between renal and hepatic toxemias as claimed by the latter. However, in preëclamptic states, King and Denis believe that the increased blood uric acid may serve as a useful test in doubtful cases, for the more toxic patients showed high uric acid values associated with a relatively small rise in the non-protein nitrogen.

Edema.—Since Zangemeister presented in 1919 his theory that the retention of water in the tissues is a causative factor in the production of eclampsia, comparatively little attention has been paid to this idea. He claimed that the primary cause of the edema is an injury to the capillary endothelium, which manifests itself in increased permeability and diminished absorptive ability, although he maintains that these changes are only indirectly associated with the etiology of eclampsia. The infiltration of the tissues is accompanied by a rise in blood-pressure and elimination of albumin through the kidneys, while the edema of the brain results in convulsions and coma. Others have confirmed the occurrence of this definite blood dilution even in normal pregnancy but in the late toxemias this is even more marked and proportional to the extent of the edema; in other words, the more evident the swelling the lower the protein concentration in the blood. The clinical observation has likewise been made that patients with extreme edema present a better prognosis, so that it may be argued that the general retention of water is a prophylactic measure adopted by the organism. Plass, who has written an excellent review of the metabolic disturbances occurring during the eclamptic state, points out that this plasma dilution may explain certain other findings which are otherwise difficult to interpret. For example, the very low values for the non-protein nitrogen constituents generally found in normal pregnancy and frequently in the toxemias may thus be regarded as the result of a simple dilution, while the increased percentage of chlorids may be looked upon as a mechanism for maintaining the osmotic pressure of the blood, which would otherwise be abnormally low.

Toxicity.—An interesting contribution to the pathogenesis of eclampsia has been made by Levi-Solal and Tzanck. By animal experimentation these

investigators have found that serum from eclamptic women is toxic to guinea-pigs in the proportion of 1 to 2 c.c. per kilo of body weight, while such animals are not affected by male serum or that from normal women even if pregnant, or from other animals notwithstanding doses six or eight times as large. This observation is in confirmation of what has already been reported by Barr and others. Moreover, they believe that eclamptic serum contains two toxic principles, one of which is capable of producing convulsions, and the other, while equally lethal, is not convulsant. The former seems to be rendered innocuous by heating to 55° C. or by disintoxicating the eclamptic by treatment. The other principle, however, is not thus dissipated and is found in the serum of former eclamptics or of albuminuric women with hypertension, and in other conditions. In other words, these facts seem to show that a part of the eclamptic toxemia is due to organic alterations which result in the production of the two toxic substances. Animals which have been subjected to the injection of these materials develop a typical eclampsia with convulsions which is rapidly fatal where the first toxic principle is employed, whereas the administration of the second makes the animals torpid and they finally die without having had convulsions. These authors are therefore of the opinion that the phenomena of eclampsia are identical with those of anaphylactic shock, because of the suddenness of the onset, the possible recurrence in successive gestations, and the frequent disappearance of symptoms with intra-uterine fetal death. Efforts to trace the origin of these toxins to placental villi were successful in so far as unautolyzed filtrates from the placentæ of eclamptics produced effects identical with those following the administration of eclamptic serum. The authors believe that drugs acting on the sympathetic nervous system would afford a protection against eclampsia, for pilocarpin hydrochlorid in the dose of 1 Mg. for a guinea-pig of 500 Gm., when mixed with a lethal dose of eclamptic serum or of placental extract prevented the death of the animal in over 80 per cent of the cases. Adrenalin, atropin, and eserin were likewise employed but no protective effect elicited. The clinical application of this method was possible in only one case, a patient who had had nine convulsions before the injection of 5 Mg. of pilocarpin, which was repeated three times in the first twenty-four hours although no further convulsions had occurred after the first dose.

Incidence of Eclampsia.—An interesting commentary on the incidence of eclampsia is presented in a report to the British Congress of Obstetricians and Gynecologists, in June, 1922, which is commented upon by Eden. It seems that there are about 600 deaths from eclampsia annually in Great Britain and Ireland and from an average mortality of about 22 per cent Eden estimates the incidence to be, therefore, about 3000 cases per annum. The maternal mortality rate varied from about 11 to 25 per cent and although the disease is less common in multiparæ, the maternal mortality is higher. It seems that the high fetal mortality is due more to prematurity than to the toxemia of the mother, likewise the narcotics; the usually forcible delivery and the deprivation of breast milk are additional factors. Commenting on the method of treating, Eden points out that natural delivery assisted or induced, yields results twice

as favorable as those following cesarean section. Accouchement forcé in all cases carried a mortality from two to five times higher than similar cases handled by more conservative measures, from which he concludes that in all cases whether mild or severe, a minimum of obstetric interference is indicated and that the methods advocated by Stroganoff and Tweedy are among the most available and satisfactory to date.

Etiology.—Chronic sepsis as the etiological factor in the production of the toxemias of pregnancy has previously been alluded to (original monograph, page 34) and J. E. Talbot has presented another paper more recently, in which he claims to show that the placental infarct is the result of hematogenous infection of the placental site, dating primarily from a point of absorption in the teeth or tonsils. His reasoning to substantiate these claims is rather lengthy but he believes that the usual symptoms of eclampsia, either with or without convulsions, are those which may be attributed to the manifestations of a septic process and that the fundamental principles upon which this conception is based are equally applicable to other infectious complexes.

TREATMENT

In so far as the treatment of the toxemias of pregnancy is concerned no noteworthy results have been accomplished although it may be recorded that the last two years have shown even more conclusively the advantages of conservative treatment, particularly in the convulsive types of the disease. Taking up first, however, the disturbances in the early months, including vomiting, there seems to be a consensus of opinion that the restriction of proteids and fats in the food, with an excess of carbohydrates supplemented by intravenous injections of glucose, have done much to bring about improvement and even cure. The insistence of a carbohydrate diet is enough in many cases to turn the tide, together with the administration of sufficient alkalis and sedatives where the latter are needed. Speaking in greater detail, I am accustomed to prescribe carefully just what articles of diet are suitable and include here the free use of cereals of all kinds, breadstuffs, and milk in moderate quantities, without cream. In addition, green vegetables of all kinds, including the free use of lettuce, celery, radishes, and fresh fruits. As the latter may cause indigestion they are best taken well cooked, with sugar to flavor. Bowel evacuations are essential and should be secured with simple cathartics. As these patients are more or less dehydrated from the constant vomiting, the use of salines is contra-indicated and the simpler vegetable cathartics such as cascara in pill form seem to give the best results. Alkalis are well borne at this time, and there are now on the market a number of pleasant and palatable preparations which can be administered without distress to the patient. The use of milk-sugar I have found of great service as it is less sweet than the cane variety and borne in larger quantities. I give it in a weak lemonade in the proportion of a well-rounded tablespoonful to the pint of water flavored with the juice of half a lemon. At least 3 pints of this agreeable drink can be taken during the course of twenty-four hours and the water seems much more easily retained

in this form than when taken plain. I have already alluded previously to the intravenous administration of sugar solution in the advanced cases of hyperemesis and my experience during the past few years confirms the good results previously obtained. A 5 or 10 per cent carefully sterilized solution of glucose administered in quantities of from 500 to 1000 c.c., frequently turns the tide in the patient's favor. The danger of glycosuria has often been referred to in cases of high carbohydrate feeding or sugar instillation, and while I have occasionally observed traces of sugar in the urine after the latter, these are transitory. Of course, in the presence of a true diabetes, the question of sugar instillation or exclusive carbohydrate feeding must be carefully considered and in the presence of a true diabetes, as confirmed by a high blood-sugar content, the question of abortion must be immediately considered if the use of insulin does not immediately provoke a good result.

Further studies in the combined use of insulin and glucose for the treatment of excessive vomiting of pregnancy have recently been contributed by Thalhimer, who now reports 8 cases successfully treated by this means. In view of the lack of understanding and the limitations of this method of treatment and the indiscriminate use of insulin injections that have come to my personal notice, I desire to call particular attention to the technic of administration. Of course, the essential idea is to combat the acidosis resulting from carbohydrate deficiency as near as we now understand this subject. The relationship of insulin to the pancreas is still obscure and the exact mechanism of its action unknown. We do know, however, that it controls diabetes and causes the disappearance of acidosis even in non-diabetic patients. It does this more rapidly, however, when glucose is administered in conjunction with it. In severe cases of hyperemesis the persistent acidosis is the alarming feature and as a vicious cycle has been established by constant vomiting, no relief can be obtained from nutriment administered through the usual channels. The intravenous administration of glucose has, however, apparently solved the problem.

In instituting this line of treatment only sick cases should be considered which have resisted the more conservative measures referred to elsewhere. Such patients should be kept in hospitals and watched closely. It is always advisable, where this can be done, to determine the carbon dioxid combining power of the blood-plasma. One hundred c.c. of the chemically pure glucose of some reliable manufacture should be made into a solution with 1000 c.c. of sterile water. The solution should remain colorless after its sterilization in an autoclave. Where a patient is severely dehydrated 200 c.c. of a 5 per cent solution can be given. The essential point is to give it slowly, taking up at least four hours for the administration through a vein in the arm. It is recommended that one unit of insulin be given for approximately every 3 Gm. of glucose. Thus for 100 Gm., 30 units of insulin are given in divided doses; 20 one hour after beginning the glucose infusion and 10 units after the second hour. In the cases thus far studied it has been found that the ketonuria is relieved in from six to eight hours. The treatment can be repeated at intervals of from one to two days depending on the patient's response

and as soon as vomiting stops the administration of food by mouth should be begun.

Lazard Treatment.—The intravenous use of magnesium sulphate in puerperal eclampsia constitutes the subject of a preliminary report by Lazard (*Am. J. Obst. & Gynec.*, Feb. 1925). The sedative action of magnesium sulphate on the nerve-cells has been known since the work of Meltzer and Auer in 1904, who employed the drug for the control of tetanic convulsions. Lazard uses 20 c.c. of a 10 per cent solution of magnesium sulphate by intravenous injection as soon after the first convulsion as possible, in addition to the usual eliminatory methods, employed, however, with the least possible handling of the patient. Lazard reports a series of 17 cases with but one maternal death, all of which were profoundly toxic, having convulsions and in coma when first seen. Among these were 11 antepartum cases, one in labor, and 5 postpartum. All of them had one or more convulsions and even where the other measures were not employed, the good results following the magnesium sulphate injections were apparent. The convulsions seemed to be controlled by the sedative effect on the voluntary muscles and no deleterious effect was noted in so far as respiratory or other paralyses were concerned. It was also found that magnesium sulphate in addition to controlling the convulsions undoubtedly reduced the edema by promoting diuresis and thus eliminating toxins. Except for some urgent obstetric indication in eclampsia, surgical interference should not be undertaken. The author is also disposed to recommend the intravenous use of magnesium sulphate in cases of so-called preëclamptic toxemia, which do not improve under the usual treatment, in the hope that the toxemia can be controlled and the pregnancy carried to spontaneous labor without the supervention of an eclamptic seizure. He has not observed any effect on labor itself, either hastening its onset or interfering with its progress after it starts.

Stroganoff Treatment.—The Stroganoff method of treating eclampsia and its modifications has continued to gain in favor during recent years and Stroganoff attempted a practical demonstration in London about a year ago. He presented before the British Association of Obstetricians and Gynecologists his most recent summary for which he collected over 2000 cases from various European clinics with a maternal mortality of 9.8 per cent. He claims that the method yields an average infant mortality of only 18 per cent and insists that the details of its execution will materially improve the results already obtained.

Stroganoff's method has been carefully investigated by H. J. Stander of Johns Hopkins University. Stander's observations of Stroganoff's material seemed to show that his results represent the lowest mortality of any large series of cases but is of the opinion that most of the cases personally treated by Stroganoff were relatively mild as compared with those observed in other clinics, because an exceptionally large proportion had no convulsions, or only one, and only a relatively small proportion had more than five convulsions. More or less confusion still exists, however, in various clinics as to the true interpretation of Stroganoff's methods and although the German clinics seem to follow his directions more closely, still there is much divergence. This like-

wise applies to France. In order to fix firmly in the minds of my readers the Stroganoff treatment as insisted upon by the author, the details of his method are presented herewith. (1) Upon admission: (*a*) Dark room with minimum of noise. (*b*) Special nurse. (*c*) Examination or disturbance of patient only when absolutely necessary, and then usually under chloroform. (*d*) 0.015 (0.01-0.02) Gm. morphin hypodermically, while under chloroform narcosis, usually about 10 to 15 Gm. of chloroform being employed. (2) One hour after admission: 2.0 (1.5-2.5) Gm. chloral hydrate per rectum with 100 c.c. normal salt solution and 100 c.c. milk. Should the patient be conscious the chloral hydrate can be administered by mouth with 100 c.c. milk.* (3) Three hours after admission: 0.015 (0.01-0.02) Gm. morphin hypodermically under 10 to 15 Gm. chloroform. (4) Seven hours after admission: 2.0 (1.5-2.5) Gm. chloral hydrate, as above. (5) Thirteen hours after admission: 1.5 (1.0-2.0) Gm. chloral hydrate, as above. (6) Twenty-one hours after admission: 1.5 (1.0-2.0) Gm. chloral hydrate, as above. (7) After each convulsion oxygen is administered as quickly as possible. This is kept up until the breathing improves, usually for about five minutes. (8) After three convulsions in the clinic: Venesection of not more than 400 c.c. is resorted to. (9) In case of frequent convulsions, chloroform and chloral hydrate to be used more energetically than outlined above. (10) If patient has been free from fits for twenty-four hours or longer after admission, and has not yet been delivered, she should be given about 0.5 Gm. chloral hydrate every eight hours for about three days. (11) Operative delivery is resorted to only when intervention becomes absolutely necessary for the sake of the child.

This method, as outlined, is followed in all cases of eclampsia during labor. In antepartum eclampsia, the same procedure is used except that usually it is advisable to employ smaller quantities of the narcotics. Stroganoff believes that postpartum eclampsia is easier to treat and accordingly recommends the same treatment as in the mild type.

Williams-Stander Treatment.—A modification of the Stroganoff procedure is now being tried out in the service of J. W. Williams at Johns Hopkins. Stander, his associate, claims, and in this I am inclined to agree with him, that a moderate rise of blood-pressure should facilitate osmosis and elimination, and represents, therefore, a protective mechanism. Venesection of small quantities of blood such as are advocated by Stroganoff can have little material value in lowering blood-pressure or eliminating toxins, and if this method is employed at all, at least from 700 to 1000 c.c. of blood should be abstracted. It is of interest to present the details of the methods of treatment now employed at Johns Hopkins Hospital in eclamptic patients:

Outpatient.—Patients with increasing blood-pressure and definite trace of albumin must visit the dispensary twice a week. If they do not follow directions, the Social Service must visit them promptly.

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* Chloral hydrate is always administered without the use of chloroform, except where the patient has had one or more convulsions after admission; then about 10 Gm. of the anesthetic are used with each dose of chloral hydrate.

Dispensary.—Patients must be sent into the hospital whenever they show: (*a*) Systolic pressure of 150 or more and + + albumin; (*b*) undue rise in diastolic pressure; (*c*) any one of the foregoing symptoms associated with severe headache, epigastric pain, or pronounced edema; (*d*) sudden amaurosis (loss of vision), even if none of the conditions mentioned previously are present.

Ward Service.—Toxemias.—(1) In moderately sick patients when the albumin does not fall to below 1 Gm. per liter within a week, or when the general condition is not satisfactory, the induction of labor should be seriously considered. (2) Very ill patients will probably have induction of labor sooner, immediate induction when amaurosis develops suddenly, either with or without epigastric pain. In nulliparæ with a rigid cervix, cesarean section may be considered.

Eclampsia.—(1) Upon admission: Patients with frank eclampsia are: (*a*) To be placed in a quiet, darkened room and to be disturbed as little as possible. (*b*) To have special nurse continuously until definitely out of coma. (*c*) To have ¼ Gm. morphin hypodermically immediately. (*d*) To be catheterized, examined medically and obstetrically, and bled for 200 c.c. under nitrous oxid anesthesia if conscious. The venesection is done only when it is necessary to obtain a blood specimen for research work. (*e*) To be placed on one side, with foot of bed elevated so long as coma persists. Mucus to be swabbed from pharynx as it collects. (*f*) To have water freely when conscious. If patient cannot drink on account of coma or lack of desire, the intravenous administration of 500 c.c. of 5 per cent glucose should be considered. (*g*) Not to be delivered until after cervix is fully dilated. Then by the simplest operative means, unless spontaneous delivery seems imminent. (*h*) No chloroform to be used. (*i*) Notify the chemical assistants as soon as patient is admitted so that the necessary observations can be made. (2) One hour after admission: If comatose, give 2 Gm. chloral hydrate in 100 c.c. of normal salt solution, and the same quantity of milk per rectum. If conscious the chloral can be administered by mouth in 100 c.c. of milk. (3) Three hours after admission: ¼ Gr. morphia hypodermically. (4) Seven hours after admission: 2 Gm. chloral hydrate as above. (5) Thirteen hours after admission: 1.5 Gm. chloral hydrate as above. (6) Twenty-one hours after admission: 1.5 Gm. chloral hydrate as above. General directions: (*a*) While eclamptic patients are under treatment, the assistants and nurses must insist upon the greatest possible quiet; (*b*) catharsis, sweating, or venesection in excess of 200 c.c. must not be employed.

Since the publication of the first appendix volume but few noteworthy additions to the literature of the toxemias of pregnancy have been made. While the investigations as to the cause of eclampsia and similar disorders have been continued, it will be necessary to await the lapse of further time to properly test the suggestions in treatment which have emanated from the same.

The good results which have attended the introduction and general adoption of the more conservative methods of handling such patients, are manifest

in the reduced incidence and mortality of these formerly more widespread disorders of pregnancy.

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BIRTH INJURIES OF THE CHILD

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In 1925, in an appendix to my original monograph published in 1922, I pointed out to what extent several hundred contributions appearing in the intervening three years had advanced our understanding of the birth injuries of the child, and to what extent this newer information requires revision or only modification of basic views concerning their causation and consequences. Again three years have passed. If anything, general interest in this eminently practical problem has further increased. Contributions of more or less importance to the subject can be found in general and special medical journals in every part of the world. It seems impractical, and would prove confusing, to summarize here the literature only of these last three years and thus necessarily make amendments to views expressed both in the original monograph and in the first appendix. For this reason this new appendix will comprise a critical review of all noteworthy papers and monographs published between 1922 and the end of 1927. The new material here presented is of such importance that I must beg every reader of my original monograph not to quote anything from it as expressing my views without first consulting this appendix in regard to the particular point.

Like the monograph itself also this appendix considers the problem of birth trauma mainly from the viewpoint of the obstetrician. Immediate symptoms are emphasized because it is essential that they be recognized immediately after delivery by the attending physician. The causation of all forms of injuries is discussed in detail because the obstetrician necessarily is greatly concerned with the problem of their possible prevention. Also the chance of harmful effect of such traumatization in birth on the later physical and mental development is of obvious interest to the obstetrician. But the treatment of such later sequelæ is better left to the competent pediatrician, neurologist, or orthopedic surgeon. For this reason, deliberately, only limited space is allowed in the monograph and the appendix to this particular feature of our problem—a point seemingly overlooked by some of my critics who have objected to the scarcity of definite information offered by me in this respect.

Approximately five hundred papers have been published within the past six years which deal with birth injuries and their effect on the physical and mental development of children surviving such injuries. Many of these contributions markedly augment our information concerning the pathology and etiology of these lesions. A few more of well-known pathologic conditions and clinical entities, still designated as congenital to indicate their intra-uterine and develop-

mental origin, now have been definitely placed into the group of intranatal injuries.

More extensively than heretofore pathologists and neurologists, as well as surgeons, laryngo-otologists, and ophthalmologists have participated in the discussion of this complex question which in the main claims primarily the interest of obstetricians and pediatricians.

As might be expected, the bulk of these newer contributions considers injuries to the central nervous system and their sequelæ, the most frequent and, at the same time, the gravest type of traumatization of the newborn.

Intracranial Injuries.—Large critical reviews of this immense newer literature have lately been presented, among which the most comprehensive and valuable are those prepared by Philip Schwartz and Dollinger respectively, occupying almost three hundred pages in the thirty-first volume of the *Ergebnisse der inneren Medizin und Kinderheilkunde* (1927). In the Clinical Pediatrics Series (D. Appleton & Co., 1926), Volume V on the *Disorders of the Nervous System in Childhood,* written by Bronson Crothers, offers to obstetricians important information and much food for thought. In another series, Medicine Monographs (Williams & Wilkins Co., 1927), one volume (XI) is devoted to a most exhaustive discussion of the *Birth Injuries of the Central Nervous System* in which Frank Ford deals with the injuries of the brain; Crothers and Putnam with those of the spinal cord. Birth injuries and their effects represented the chief topic of discussion at the Düsseldorf meeting of the German Pediatric Society, and many of the papers read there will be mentioned in the following pages. In this country this same topic seemingly has of late become a favored subject for symposiums. It would be impossible to enumerate here all the comprehensive papers prepared for such occasions, but as of distinct merit might be mentioned those of Bland, Ford, Ruh and Barney, Signorelli, etc.

It seems that it is accepted now as an established fact that approximately one-half of all infants, either stillborn or dying within the first few days of life, reveal at autopsy some sort of laceration of the dura mater, or more particularly of the tentorium. Thus, in one of the largest number of observations more recently summarized, Holland found tears in the dura mater in 81 of 167 fetuses, and in 64 of them he discovered a bilateral laceration of the tentorium, none of these lacerations being necessarily responsible for the infant's death.

In a newer investigation, made under the auspices of the Medical Research Council of the British Empire, Holland and Lane-Claypon report that tentorial tears occur in one-half of all the cases in which forceps had been applied; approximately with the same frequency in spontaneous breech labors, and were found in just one-fourth of all autopsied cases. From a study of 160 cases of natal and neonatal death, Tingle concludes that more fetuses die as the result of excessive trauma during delivery than from maternal or fetal diseases. Guenther analyzes 4000 deliveries with a stillbirth mortality of 4.1 per cent, to which must be added another 1.6 per cent of early postnatal mortality. He finds that it is impossible to express in exact percentage figures the relation of birth trauma to infantile mortality, but it would seem that such

injuries could represent the direct cause of death in approximately one-third of the cases. Most endangered undeniably are the premature babies.

Grulee writes: "Of the conditions that are known to be especially fatal in the newborn infant, none is more frequent than intracranial hemorrhage." Equally pessimistic sounds Wohlwill's warning to the profession: "The loss of human life due to birth injury approaches in its social bearing the loss caused by any of the known and more common diseases affecting large masses—such as tuberculosis."

Yagi discovered in 96 autopsied babies 31 intracranial hemorrhages as responsible for the death. Of these, in 16 instances some obstetric operation had been performed while the remaining 15 labors had ended spontaneously. And since this report comes from Japan we might mention the noteworthy though not surprising fact that practically identical statistics now reach us from every part of the world. Hone reports from Australia an incidence of 48 per cent of dura mater lacerations in 167 autopsies of infants, as a matter of fact, in 100 per cent of all breech deliveries in this series. From Calcutta comes the description of a long, fatal tentorial tear discovered by McSwiney in an eighth child, born after a short labor without any interference and dying fourteen hours postpartum. In France, Plauchu and Chaix discussed before the Obstetric Society of Paris the question of meningeal hemorrhage (2 cases) subsequent to spontaneous labors and are told by Reuther in the discussion that in a series of 100 intracranial hemorrhages studied by him he encountered 26 babies born spontaneously.

If Keene gives decidedly lower figures we might suspect a not quite perfect autopsy technic. This conclusion seems justified by studying, for example, the report of Wilson on necropsies on newborn infants, showing conclusively that carefully done necropsies will reveal a great variety of entirely unexpected serious lesions in many organs.

However, such statistics based on postmortem findings obviously do not give us a definite clew in regard to the actual occurrence of intracranial traumatizations. This incidence naturally must be higher than that calculated from autopsies. We shall return to this point when describing the pathohistologic findings of Schwartz and discussing spinal puncture as a diagnostic aid.

Recent investigations fairly well agree with the claim, made some time ago by German writers, that only approximately one-half of dura lacerations cause sufficient hemorrhage to account satisfactorily for the death. In the other half, then, they merely express the potential risk to the infant in case such a laceration accidentally were to have involved a larger vessel, and furthermore demonstrate the ever present danger to the integrity of the dura from external mechanical factors.

The problem of intracranial stress as the result of changes in the shape of the skull during the process of molding is most lucidly presented by Holland. He supports the opinion of former investigators that compression of the head raises the vault of the cranium and with it the falx, causing the falx itself or the tentoria to tear when overstretched. It is the inevitable, exaggerated compression of the skull in face and brow presentations, and its rapid compression

in the delivery of the after-coming head in breech labors, which account for the high percentage of lacerations and hemorrhages among infants born in this manner.

With certain features of this theory Greenwood takes issue. He made plaster-of-Paris casts of the newborn's head, reaching from below the frontal eminences to below the occiput, including thus the whole of the skull surface subjected to molding. Another similar cast was taken a week or so later. These casts permit very exact measurements in various directions, and conclusions drawn from them force us to modify some of our ideas concerning the changes of configuration resulting from molding.

These exact studies leave no doubt that in normal cases of vertex presentations the passage of the suboccipitobregmatic circumference through the pelvic brim does not, as now assumed, increase the vertical diameter of the cranium. On the contrary, the tendency is to shorten this diameter and to cause merely an overlapping of the two parietal bones. The lengthening of the head is anteroposterior and not vertical. That in many vertex cases dural septa are torn is an admitted fact, but at least in normal vertex presentations this injury cannot be explained by any raising of the cranial vault. This mechanism, however, undoubtedly might be responsible for dural lacerations in occipitoposterior presentations, in which there usually is some deflection; in brow presentations, and especially in breech labors. In the after-coming head, as can be clearly shown, the vertical diameter always becomes increased. This lengthening begins with the very first contact of the head with the pelvic brim and, if there is any difficulty, the elongation will be extreme and beyond compatibility with life.

Greenwood is convinced that the Schultze method of resuscitation through lateral compression of the head might be responsible for dural injuries in some cases, as is also claimed by Siegmund and many others. Kermauner of Vienna has discontinued teaching of this dangerous method and Ylppoe declares it to represent malpractice if done on a premature infant.

Beitzke thinks that the direction of the compression, occipitofrontal or bilateral, determines whether the tentorium is torn approximately in the middle of its free edge or at the site of its attachment to the falx. The latter type of lesion is more likely to occur during excessive bilateral compression because it also causes the cerebellum to be pushed upward against the tentorium, a point already emphasized by Wilke in 1912.

Beitzke's views are fully confirmed by Glatz in an analysis of 96 cases. He emphasizes that the more dangerous laceration of the free edge most often is the result of a forceps application or of extraction of the after-coming head by means of the Veit-Smellie maneuver.

Baker uses the term "cranial stress" in a somewhat different meaning since he considers it dependent upon two factors; namely, the outside pressure on the cranial contents and the degree of congestion of the cerebral veins and dural sinuses. Such a definition of "stress" might prove confusing. In my opinion congestion can be regarded only as a contributory factor, favoring but not causing rupture, a view now rather generally accepted and more recently again

expressed by Glatz, Newman and Levy, and others. More shall be said about this congestion later on in connection with intra-uterine asphyxia of the fetus.

Baker feels that tentorial tears are signs, not so much of undue force as that this force has been exerted in the wrong diameter, *i.e.*, the occipitofrontal. This emphasis rather on the direction than on the degree of force probably contains a truth of great importance to the obstetrician. Of course, all brusque force during the extraction of the head or in manipulation of the newborn is objectionable. But not too often can the evident fact be restated that an intracranial traumatization not necessarily proves undue force or casts any reflection on the skill of the attending physician. We now are thoroughly familiar with the relatively high incidence of every type of serious lesion in normal, spontaneous labors.

The head of the normal, full-term child seemingly offers a striking degree of resistance to external trauma, as clearly shown in experiments made by Fog. He was prompted to make these investigations by a new instance of a baby—as the result of entirely unexpected birth—falling from the toilet of a moving passenger train on to the train tracks. There are now four observations of this sort on record and two of the babies survived without harm, though lying on the tracks they had furthermore been exposed to the cold air for a long time.

While speaking of fatal dura tears in spontaneous labors I might mention two other papers. Joergens discusses the important medicolegal aspect of tentorial tears in regard to suspected infanticide. Heretofore intracranial lesions discovered at coroner's autopsies had been accepted as supporting the suspicion of an external trauma, presumably inflicted by the accused mother. In the light of our present information we must accept these findings as actually proving the claim, often made by these mothers, that they were surprised by the unexpected and quick expulsion of the infant. This same point is considered from another angle in a more recent contribution by Alexander-Katz. He demands that in every case of suspected infanticide the necropsy must include a careful study of the skull and its contents. The protocols of the coroner's office in Hamburg since 1919 show a steadily increasing number of fatal tentorial tears. Out of a total of 81 autopsies, in 23 the death of the infant was satisfactorily explained by such injuries. It is a noteworthy fact that in 7 of these cases the postmortem findings definitely exonerated mothers arrested on suspicion of infanticide. In 3 of these 7 cases the mothers had claimed that the labors were precipitated and the autopsy findings were accepted as supporting their defense. It seems superfluous to mention that only tentorial tears associated with hemorrhage enter into this forensic problem since tears undeniably can be produced also by rough handling of a dead baby. Under these conditions, however, no "vital reactions," such as free hemorrhage or suffusion of tissue around the tear, will be found.

More reports have appeared of fatal intracranial hemorrhages discovered in babies delivered in cesarean sections (Heidler, Tauber, Tunis, Siegert). They are seemingly most often caused by quick extraction through too small a uterine incision. Siegert and Heidler point in this respect to special risks

of the low, cervical incision. In Siegert's case a placenta prævia attached anteriorly rendered extraction of the head particularly difficult. In a case of Larini a cesarean baby died ten days postpartum, apparently from a hemorrhage around the nucleus of the vagus.

By far the most significant result of recent studies consists in new information concerning the character and the possible later consequences of apparently common lesions of the brain substance sustained during labor. This work, chiefly done in the Pathologic Institute at Frankfort by Philip Schwartz and his coworkers, was originally presented by Schwartz in an exhaustive, well-illustrated and most instructive monograph of two hundred pages (*Ztschr. f. d. ges. Neurol. u. Psychiat.*, 1924, 90: 263) and more briefly summarized by Fischer and Siegmund.

One can readily agree with the allegation that the almost general adoption of Beneke's method for the study of intracranial pathology of the newborn rather one-sidedly brought about an overestimate of the significance of dural lesions, and inevitably caused the now evident neglect of injuries to the brain substance itself.

If the skull is opened by a method very similar to the customary Beneke technic, but with the skull flaps made larger (by running the incision anteriorly lower down to the orbital ridge, laterally down to the attachment of the ear, and posteriorly below the transverse sinus) it is possible to remove the hemispheres in toto and to inspect the tentorium and the falx. After a preliminary hardening in formalin solution, the brain was studied histologically by Schwartz. Hemorrhages or distinct areas of degeneration in the substance of the brain, outside the known and fairly common pial and tentorial hemorrhages, can even macroscopically be recognized in 65 per cent of all infants up to the age of 5 months. Their arrangement and localization can leave no doubt concerning their origin. Their distribution clearly expresses traumatization of the brain by the mechanism of labor.

The hemorrhages are within the area of the tributaries of the vena magna galeni, vena terminalis, vena lateralis ventriculi, ramus ventricularis of the vena basalis, and vena chorioidea. The areas of soft degeneration lie chiefly in the white substance of the hemispheres and in regions drained by the vena terminalis and the vena lateralis ventriculi. Often extensive areas of the nucleus caudatus are found destroyed by hemorrhages from the vena terminalis.

As clearly demonstrated by Schwartz, the actual histopathologic condition in each individual observation stands in a very definite relation to the duration of extra-uterine life. It is Schwartz's belief that the entire problem can be understood fully only by extending such exact histologic investigations to all infants dying up to thirty days after birth and even later. Thus he arrived at the conclusion that there are but few infants that fail to reveal at least some traces of such traumatic brain lesions.

There unquestionably exists a typical progression of histologic changes, seemingly leading from hematoma through necrosis or fatty degeneration of the glia, to diffuse sclerosis, cyst formation, porencephaly, etc. In the belief

of Siegmund the entire further development of the infant's brain to a great extent is determined by disturbances set up by birth, an opinion similarly but more emphatically expressed by Ylppoe, who asserts that intracranial traumatic lesions, by him discovered in 90 per cent of all prematurely born infants, actually determine whether they will live and how they will later develop.

Fischer summarizes the findings, presented in all their details in Schwartz's monograph, as follows:

Hemorrhages in the brain substance occur in the newborn chiefly in two forms: (1) Very small, and occasionally larger, isolated hematomata in the white substance, radiating in an almost typical manner from the walls of the two lateral ventricles; (2) a very typical complex of hemorrhages, arranged strandlike, often in both hemispheres, distinctly ascribable to an injury of the vena terminalis, a type first described by Schwartz and since confirmed by others.

Outside these hemorrhages there can be seen opaque, grayish yellow spots, usually in the immediate neighborhood of the lateral ventricles, which under the microscope are found to be anemic, necrotic areas, or fields showing a softening from fatty degeneration.

The dependence at least of the hemorrhages upon birth trauma seemed evident from the start but very careful investigations finally established as well the relation of the necrotic or fatty degenerated areas to this trauma. If the degeneration is diffuse its gradual development into porencephaly can be demonstrated.

That the skull represents the all-important protective factor was convincingly shown by control studies made on the brains of newborn animals (calves, dogs, and cats) with thick bones and no fontanels. In not a single instance could such anomalies be discovered in the brains of these animals. Furthermore, in the newborn infants, traumatization of this character invariably was found more often and more extensively in the prematurely born and in infants with soft skull bones.

Direct pressure, strong compression of the entire brain, shearing, and a sort of concussion of the brain are the traumatizing factors. They are assumed by these authors to cause circulatory disturbances through their effect on the vasomotor system. Either stasis or anemia is the primary result which then apparently forms the causative factor for the structural changes.

With these heretofore unknown and nevertheless common histologic changes in the newborn's brain, Schwartz not only justifies his belief in an almost physiologic traumatization of the brain during labor but as well opens new avenues for speculation in regard both to the cause of such anatomic changes and to their possible relation to defects manifesting themselves later in life. A great deal of investigative work was thus stimulated. As a whole every new contribution tends to confirm Schwartz's pioneer work and the various conclusions drawn from it. There are a few dissenters, and considering in this connection first only the anatomic findings, it must be mentioned that Wohlwill still doubts Schwartz's belief, that all this fat tissue, rather

diffusely seen in the newborn's brain, necessarily represents fatty degeneration, especially of traumatized glia cells. Other investigators ascribe these fatty cells to normal and entirely physiologic changes. As a matter of fact, they have been observed, *e.g.,* in the brain of a stillborn baby obtained in a cesarean section, and are as well seen in older nurslings dying from infectious diseases. Wohlwill refers to the work of Gohrbrandt, Schuetz and Neubuerger and emphasizes that such a fatty degeneration of isolated glia cells should not be confused with truly degenerated areas in the brain. He is, however, willing to admit a typical, progressive change of actually traumatized brain tissue, in accord with Schwartz's theory, for a remaining large number of cases in which typical fatty, necrotic areas are found in association with rusty brown discolored tissue representing indubitably the remnants of hemorrhages.

The origin of the various histologic anomalies described by Schwartz is explained by him as follows: As long as the membranes are intact any increase of intra-uterine pressure, caused by uterine contractions, is equally distributed in accord with the laws of hydraulics. Rupture of membranes and dilation of cervix bring a significant alteration of conditions. Within the area of the dilated cervix the presenting part of the head is now exposed to the lower outer atmospheric pressure. In this region, therefore, from now on a neutralizing counterpressure is missing. Particularly later in labor, with wider dilation of cervix and increased intra-uterine pressure by the added force of voluntary muscles, a very marked difference between inner and outer pressure (estimated to amount up to 27 Kg.) is created. Under the influence of this overpressure the fluid contents of the fetal body, especially lymph and blood, are pressed towards the area of lower compression, or expressing this phenomenon in its negative phase, the zone of lower pressure actually exerts a suction effect. Under its influence develops the caput succedaneum, or under certain conditions a cephalematoma. Obviously this combination of overpressure with suction will produce some effect as well on the contents of the skull. Smaller veins in the meninges and within the brain and venous sinuses may become overfilled and eventually might rupture under the influence of mechanical factors resulting from the molding process. Blood stasis by itself may interfere with proper nutrition and initiate degenerative processes, especially in brain areas drained by terminal veins. Schwartz, in his original paper and various summaries published since, describes in detail these circulatory disturbances and their consequences within the brain and attempts to explain why these disturbances are most likely to occur in the vena galeni and its smaller and smallest tributaries. Most of newer contributions confirm Schwartz's theory of the origin of these hemorrhagic lesions on the basis of a negative pressure. They seemingly can be produced at will in experiments on animals whose heads are exposed to such a suction effect under glass domes connected with air pumps (Berberich, Metzger, Voss, Wieders).

Before leaving this subject I will mention that these hemorrhages in the smaller branches of the vein of Galenus have more recently been explained by Holland in a manner less complex and entirely in accord with the more general view that the tearing of dura folds and sinuses is dependent upon undue intra-

cranial stress during molding: The vena galeni extends between a fixed sinus and the relatively movable brain. In the process of molding the vertex is raised and thus the vein stretched and at the same time sharply kinked. Resulting excessive stasis then may cause the bursting of the vein itself or of its tributaries.

With such micro- or macro-scopic hemorrhages discoverable according to Schwartz in 95 per cent of all autopsies of young infants, it seemed only natural to expect that symptoms resembling those of a concussion of the brain should manifest themselves immediately or soon after birth of almost every child and particularly of a firstborn infant.

Stern and Schwartz examined 100 live newborn babies up to the age of 10 days and found in most of them periods of nystagmus alternating with intervals during which this anomaly could not be seen. Most often the nystagmus started spontaneously, in other cases the movements could be brought on simply by a slight turn of the head to one side. The horizontal type of nystagmus predominated, and only in 4 babies was the vertical type present.

This rhythmic rolling of the eyeballs was most marked within the first few hours after delivery. The older the child became, the smaller were the excursions, the longer the intervals between the attacks of nystagmus. Of 44 infants, in whom all the conditions of labor were perfectly normal, 15 had no nystagmus, while of 11 babies, born in abnormal presentations, all showed the anomaly. Out of 24 cases of contracted pelvis, 20 had a spontaneous nystagmus, and in 3 of the remaining 4 instances without nystagmus, the pelvic deformity was very slight. Of 38 firstborn children only 8 failed to exhibit the anomaly, while of 52 babies of multiparous mothers 13 had no nystagmus. These same authors were able to demonstrate convincingly the relation both of frequency and duration of nystagmus to the degree of molding of the head and as well to the duration of the second stage of labor.

Stern in another paper designates this spontaneous nystagmus as the most sensitive reagent to prove a traumatization of the brain. Peiper, while admitting its occurrence as undeniably the immediate consequence of the birth process, warns against the increasing and misleading tendency of accepting this phenomenon as conclusive proof of an actual hemorrhage. In his exhaustive study of the problem, Heidler mentions 6 cases of typical birth contusion of the brain, in which autopsies showed that the symptoms, in 4 instances, had been caused by a marked hyperemia, and in the remaining 2 cases by an edema of brain and meninges.

Berberich and Wieders assumed that mechanical influences capable of affecting the brain to such an extent could not fail to exert some deleterious effect also on other organs of the head. Stump, Sicherer, and more recently Jacobs, have proved the high incidence of retinal hemorrhages in newborn infants as the expression of a birth trauma of some sort. Rowland's recent decidedly lower figure of 2.75 per cent of retinal hemorrhages discoverable within the first twenty-four hours (against 12.1 per cent of Jacobs) is surprising since the actual occurrence undoubtedly ranges much higher. Lachman just reported from the Johns Hopkins laboratories results of a histologic

study of 73 pairs of eyes removed from stillborn infants and others dying within the first few days. There were found in 5 of them retinal, in 6 choroidal, and in 2 others both retinal and choroidal hemorrhages which represent over 17 per cent of fresh intra-ocular hemorrhages. He emphasizes the frequency of the choroidal hemorrhages which heretofore have not even been suspected to exist. Induced by similar experiments made by Berberich, Metzger ascertained that retinal hemorrhages could be produced in the eyes of newborn animals by exposing their heads to the effect of negative pressure. He concludes that Schwartz's theory of cerebral hemorrhages being due to suction as well applies to the fairly common intra-ocular hemorrhages of the newborn. Confirmative proof for this assumption Stocker finds in the fact that in immediate ophthalmoscopic examinations of 20 cesarean babies retinal hemorrhages could not be discovered in a single instance. In those cases, however, in which the membranes had ruptured some time before the operation a marked venous stasis was seen in the eyes.

Berberich and Wieders also investigated spontaneous and experimental nystagmus of the infant by employing both the caloric test and the turning table. The overwhelming majority of infants with deficient caloric reaction they found to be spasmophilics, idiots, epileptics, or neuropathics. The turning table gave results which in general exactly coincided with the caloric tests. All their findings strongly support the assumption of a serious traumatization of the brain.

Distinct alterations of the inner ear, including hemorrhages, have been discovered in the newborn by Voss. The relation of birth trauma to the auditory apparatus is discussed at length by him in several papers. It was this theory of negative pressure which suggested to Voss the likelihood of hemorrhagic changes in the inner ear. He examined 40 ossa petrosa, obtained from 28 stillborn or very young infants, of which 23 at autopsy had exhibited evidences of intracranial damage. These bones in large numbers showed a diffuse hyperemia, often with micro- or macro-scopic hemorrhages, occasionally associated with distinct degeneration of epithelium and nerve structures. In some of the somewhat older infants he discovered distinct remnants of older hemorrhages. Therefore, he, like other investigators, began to study experimentally the effect of suction and was able to reproduce at will all types of meningeal and cerebral hemorrhages, as well as hemorrhages in the eyes and in the cavities of the petrous portion of the temporal bones.

In 90 per cent of autopsies of older infants, a figure well coinciding with that given by other writers, Voss found evidences of an otitis media, which he, however, does not accept as positive proof for a preceding traumatization of the ear. Berberich's experiments led to practically identical findings. Similar are the results of investigations made by Thieleman with a negative pressure of 220 Mm. Hg maintained from three-quarters to two hours. Metzger specifically states that in young infants the seriousness of clinical symptoms of intracranial lesions seems to be proportionate to the degree of hemorrhagic change discoverable in eye or ear.

This leads us from the etiology and pathology of cranial birth trauma to a

discussion of immediate symptoms, a topic most thoroughly covered in that exhaustive analysis of literature presented by Dollinger.

Schwartz feels that the almost physiologically positive Babinski reflex of the newborn, recently found positive in 43 per cent of 88 normal and healthy infants within the first week of life by De Angelis, will have to be studied and analyzed in the light of all this newer information concerning the condition of the brain immediately after birth. He doubts that this inverted plantar reflex has anything to do with impairment or underdevelopment of the pyramids but believes it more likely dependent upon an injury of the corpus striatum.

The testing of any reflex in the newborn, in the opinion of Dollinger, is of little practical value and this holds particularly true for the Babinski. When positive, it possibly but not necessarily indicates intracranial damage. It must, however, be admitted that the reflex seemingly is less often positive in perfectly normal newborns than in those in whom some injury can be suspected.

Ylppoe places considerable reliance on the so-called "Hampelmann" phenomenon seen in traumatized premature infants. Tapping on the sternum causes flashlike stretching and abduction of all four extremities (like in a well-known toy for children by pulling a string). Berberich and Wieders confirm this observation.

Certain disturbances of the mimic musculature as result of brain trauma are discussed in detail by Neurath. He accounts for the relative frequency of only temporary affections of the facial nerve by the common tearing of vessels near their entrance into the longitudinal sinus. The extravasated blood would naturally gravitate laterally and backwards towards the base of the brain. He describes the following case: A baby, extracted with forceps, soon afterwards seems to smile. This striking smile, instead of a more natural facial expression of crying, later could be reproduced at will by bringing a sharp smelling substance to the baby's nose. The peculiar anomaly of facial expression in this case is ascribed by him to a traumatic lesion in the middle portion of the optic thalamus, possibly only of one side.

When Kirby, in a careful analysis of all available information concerning congenital oculofacial paralysis, arrives at the final conclusion that no really satisfactory explanation for the occurrence of this condition is extant, the thought must suggest itself that here also we possibly deal only with the sequela of an intracranial birth injury—a possibility not even considered by him.

Several authors mention a marked wrinkling of the skin of the forehead. This might be due to a lesion somewhere along the third cranial nerve and then often is associated with other ocular motor disturbances—or might solely be the expression of pain. A peculiar, whining cry occasionally interrupted by a sudden outcry, rather generally is ascribed to a severe headache.

Not very valuable by themselves as diagnostic symptoms but surely suggestive of an irritation of certain medulla centers in newborn infants, suspected of being traumatized, are persistent singultus, frequent yawning and possibly also continued vomiting.

Behrendt emphasized the fact that "persistent spitters" among very young

infants often show various symptoms of nervous hypersensitiveness, are spasmophilic or have tremors. This identical observation was recorded by Dollinger and, since among his own cases many of these babies have been born after difficult labors, he concludes that the evident hypersensitiveness, presumably in part expressed in this habitual vomiting, might be ascribed to the traumatization of the brain in birth.

It is obvious that such vomiting will seriously interfere with nutrition, especially when associated with difficulties of suckling and swallowing, acknowledged to be common immediate sequelæ of intracranial injuries. It is likely that a death occurring under such circumstances will be incorrectly classified as due to debility or nutritional disturbance.

Schwartz, like Ylppoe, is surprised that obstetricians and pediatricians so long have been satisfied in applying to definite clinical pathological conditions such terms as asphyxia, debility, atrophy, or spasmophilia, which in the adult never express anything but a mere symptom. He feels that his own investigations at least justify the hope that all these conditions some day possibly will be brought into a direct and specific relation to certain brain lesions sustained in birth.

No characteristic cardiac symptoms, pathognomonic for intracranial trauma, are known. Indeed, it is almost typical for the fatally injured baby that heart action will continue for some time though respiratory activity has never started.

Various efforts have been made recently to employ certain blood findings in the diagnosis of intracranial hemorrhages. Investigations of Schwartz and his coworkers have demonstrated that an increase in the iron contents of the infant's blood (and of other tissues) can be noticed, this accumulation reaching its maximal height about two months postpartum. These findings strongly suggested a direct connection of this phenomenon with the amount of blood destroyed during labor, and with the degree of blood extravasation associated with various birth injuries. In studies made by Buengeler, in part by Buengeler and Schwartz, the fact was established that the blood alterations caused by the resorption of extravasated blood are in general identical in the adult and the infant, and furthermore that these changes as a whole are the same as seen to follow the parenteral introduction of protein substances. There occurs an increasing hyperleukocytosis with a shift of the polynuclear blood-picture to the left, often up to the appearance of myelocytes, followed by a gradual retrograde change towards a lymphocytosis. Buengeler offers a rather appealing explanation for the existing disagreement among writers in regard to what constitutes the normal blood-picture of the newborn baby. Studying 150 infants from birth up to the ages of a few weeks and even months, he found in some of them at birth a hemogram identical in every respect with that accepted as normal for the adult. Such findings could be ascertained in the cord blood of premature, full-term and seemingly overcarried babies. In a second group the cord blood was found to be normal, but within the next five to twenty-four hours, on repeated examinations, there could be noted this shift to the left with a gradual return to the preceding normal picture within three

to five days, though there might still have remained a slight leukocytosis. There was a third group discernible in which already the immediately taken cord blood showed this marked shift to the left, chiefly expressed in the relative increase of lymphocytes, followed by gradual return to a practically normal hemogram within four to five days. As in the two other groups, also in this it could be shown that the deviations from normal were entirely independent from the degree of maturity. Since these changes are identical with those seen in adults incident to resorption of extravasated blood, Buengeler feels fully justified in concluding that any deviation of the blood-picture in a newborn from that accepted as normal in the adult must be considered as pathologic. It expresses a reactive change to the resorption of blood extravasated as the result of some birth trauma. He furthermore ascertained that babies showing a marked shift to the left at birth, as a rule, lived only a few days, again entirely independent from the degree of their maturity. Autopsies, whenever done in such cases, without any exceptions revealed larger hemorrhages, in various internal organs, intracranial, or in the skin, usually in form of a large cephalematoma. He saw newborn infants with 100,000 leukocytes to the cubic millimeter, with up to 115 normoblasts and 30 myelocytes to 100 white cells. He feels that this discovery clears up all controversial points in regard to the question of the normal hemogram of the newborn infant.

Taking into account other investigations of the iron metabolism of nurslings (*e.g.,* Schwartz, Baer and Weiser) and studies concerning the accumulation of bile pigments, etc., Dollinger is inclined to accept an abnormal hemogram immediately after birth as definite expression of blood destruction incident to labor.

Too recently to have permitted a control of their findings, Gierthmuelen and Jess thoroughly disagree with Buengeler. They acknowledge this occasional anomaly of the newborn's hemogram (incidentally also claiming that the premature infant is likely to show a more marked leukocytosis and more nucleated reds) but are unwilling to ascribe this change solely to a process occurring in the infant himself. This very same shift to the left, actually more marked than in the infant, can as well be discovered in the mother. They are inclined to believe that the alterations of the maternal hemogram are caused by certain metabolic end products, possibly by some hormones which seemingly by way of the placenta can be transferred to the fetus, producing in him the identical reactive changes of the blood.

Some writers have claimed that intracranially injured babies not so rarely show a persistently low temperature or erratic changes of temperature. This phenomenon in their opinion suggests lesions in the corpus striatum which seemingly often is the seat of smaller hematomata (Dollinger).

The importance of disturbed respiration as an immediate symptom is fully discussed in my monograph and therefore only a few recent contributions to this question need be mentioned.

Observations of peculiar attacks of arrest of breathing in newborn and young infants, a state of normal respiration suddenly and repeatedly inter-

rupted by periods of apnea and cyanosis, have occasionally been recorded in pediatric literature. Recently, Still dealt with this perplexing condition and expressed the belief that these attacks must be due to some affection of the respiratory center itself. A most substantial basis has been furnished for this theory by Kirkwood and Meyers in a thorough study of a case of inspiratory apnea ending fatally. This infant appeared to be normal and well on the first day and did not manifest the first signs of trouble until the third day. It suddenly ceased to breathe for a short while and turned blue, then again breathed normally. Several similar attacks recurred. During the state of apnea some slight twitching was noted; a turning of the eyes, etc., and later convulsions appeared and the baby suddenly died.

Lundsden, who recently had made extensive investigations on cats concerning the exact location of the automatic respiratory center, performed the autopsy on this infant. He discovered hemorrhages in the pons which, in his opinion, paralyzed this center and therefore Kirkwood and Meyers suggest, with seeming justification, that minute hemorrhages in the pons probably are not infrequent in the newborn and might occasionally represent the not recognized cause of a neonatal death.

Another respiratory phenomenon, chiefly an irregularity of breathing, but associated with jerky motions of the head and peculiar lateral motions of the eyes (a sudden deviation to one side with very slow return to the middle position) which often occur together with spastic contractions of the orbicularis and twitching of the mouth, is well known among German lay people as the "Staeupchen." The condition has been described by Zipperling in 1913 as a perfectly normal occurrence in the newborn, and in the same year also has been discussed by Klotz, but has not since been mentioned in medical literature. Dollinger recently emphasized the frequency of this phenomenon in premature babies, having no doubt that it really is an expression of some brain traumatization. This view now is shared by Langstein in the last edition of the *Handbook* of Pfaundler and Schlossmann, and also by Rietsche in his textbook of pediatrics.

A somewhat musical inspiratory stridor, quite different from that caused by an enlarged thymus, but closely resembling the stridor of laryngospasm, has been described by Thomas. From the careful study of several cases, including autopsies, he concludes that this is a cerebral stridor due to hemorrhages irritating certain cortical centers. This explanation has been accepted by Langstein. More recently Munro reported 3 cases of hemorrhage into the lateral ventricles. All three babies before death presented the symptoms of an obstruction of the air passages; one had actually been intubated for this reason. Enlarged thymus had been excluded by x-ray study. At autopsy the air passages were found entirely unobstructed.

Later on, in the discussion of brachial plexus injuries, I shall have occasion to speak of respiratory anomalies occurring in instances of concomitant damage to the phrenic nerve.

This leads us to the question of asphyxia. Asphyxiation plays in the problem of intracranial damage a peculiar double rôle, being looked upon by

some as a possible immediate cause of such a lesion, by others considered rather as its effect.

Newer, thorough researches into this problem, the most exhaustive having been given to us by Heidler, as a whole confirm the view maintained in my monograph, that suffocation *per se* might be responsible for the rupture of smaller veins but can never satisfactorily account for the rupture of larger sinuses and laceration of dura folds, especially of the tentorium. Congestion of vessels and of venous sinuses between dura folds acts solely as a contributary, predisposing element, since an engorged vein or sinus, more likely than an empty one, will rupture under a given strain. When injured, the distended vein or sinus certainly will extravasate a larger amount of blood. Prolonged asphyxiation probably is a factor in reducing blood coagulability and thus indirectly might become responsible for the ultimate discharge of a fatal amount of blood from even only a very small damaged vessel. Suspicion of beginning fetal asphyxiation undeniably prompts many a hasty artificial delivery which always implies additional risk to the fetus. Thus it will be seen that asphyxiation is of considerable significance in the problem of intracranial hemorrhage though not as direct cause of it.

An analysis of Heidler's figures proves very instructive. He had 283 cases in which a careful necropsy, obviously including the head, permitted a fairly exact determination of the actual cause of death. They comprised 173 fatal intracranial traumas, 58 premature infants without visible intracranial hemorrhages, and only the remaining 52 cases could possibly be classed as true asphyxias. However, even in this last group there were only 15 instances in which fatal suffocation was evidently due to such conditions as placenta prævia, abruptio placentæ, prolapsed cord, or severe eclampsia. He admits that even in the remaining 37 cases of this last group, smaller hemorrhages affecting directly the respiratory center (no microscopic studies had been made) might have actually placed them into the class of birth trauma. He also mentions in this connection that some of them might have succumbed to a cause more recently suggested by Kermauner: An anomalous atlanto-occipital joint which when forcibly stretched in labor causes pressure against the medulla oblongata. Heidler is certain that out of every 100 babies, seemingly the victims of asphyxiation, at least 70 to 80 actually have succumbed to traumatization and that probably not even in the remaining approximately 25 per cent death was positively due to suffocation. Taking, for example, his figures for tentorial tears, many interesting facts become evident. There were ascertained 65 such tears after breech labors. Of these, 19 babies were dead when born, 46 were asphyxiated and of these 30 could not be resuscitated, while 16 died within the next few days. Or if we take the infantile deaths after spontaneous labors in vertex presentation: 53 showed marked intracranial hemorrhages; while cerebral hemorrhages were not directly visible in 32, they represent only in part true asphyxia. Of 37 tentorial tears after forceps extractions (all done with the Kielland instrument), 12 babies were born dead, 25 in a state of asphyxiation. In addition there were 20 fetal deaths after forceps application; in 10 no cerebral lesion was visible to the naked eye, in the remain-

ing 10 no head autopsy was made, therefore undeniably a few more instances of fatal intracranial damage were included.

Thus Heidler's studies furnish valid support for the demand—vainly made now for several years—that the asphyxiated, *i.e.*, not properly breathing newborn baby, in its best interest always should be looked upon as a probably traumatized baby. Only the very gentlest maneuvers might be employed in its resuscitation. The recommendation, possibly even the description, of the Schultze method of swinging should promptly be eliminated from all textbooks of obstetrics.

That postpartum asphyxia in the overwhelming majority of instances is due to an intracranial damage, is a fact of great importance to the obstetrician not solely in regard to the question of resuscitation. Asphyxiation of the fetus undeniably may begin relatively early in labor and the recognition of this condition for a long time has been accepted as a justified indication for the speedy removal of the fetus from the uterus.

We are well acquainted with various, chiefly mechanical factors, such as compression of cord, ablatio placentæ, placenta prævia, etc., which can disturb fetoplacental circulation and induce fetal suffocation. However, in the light of our present knowledge of the marked preponderance of intracranial lesions as the actual cause of postpartum asphyxia, we are forced to consider them as probably of equal significance as well in the causation of intra-uterine asphyxia. Thus the problem of operative termination of labor in the interest of the seemingly threatened fetus takes on a quite different aspect. In this connection we are facing several evident facts and some difficult questions. In cases in which intra-uterine asphyxiation is actually caused by an insufficient oxygen supply only prompt removal of the fetus from the uterine cavity would seem to offer any hope for success. If, on the other hand, the signs of a beginning asphyxiation are due to some cerebral trauma, any method of artificial quick delivery that would add to the already existing traumatization can only reduce the chances for the infant. Thus naturally the question arises: How can we differentiate an intra-uterine asphyxia, arising from mechanical interference with placental circulation, from one induced by cerebral trauma? No difficulty will be experienced in this respect in cases of placenta prævia, or, say, of a prolapsed cord.

Passage of meconium according to Schultze and others in the large majority of cases is entirely independent of asphyxia and is of clinical significance only when found associated with that one most important sign of intra-uterine asphyxiation, namely, an irregularity of fetal heartbeats.

A great deal of literature has accumulated in the last few years concerning the actual significance of variations in the fetal heart rate. There exists fairly general agreement that a slowing of the rate is decidedly more ominous than any temporary acceleration, and that a retardation below 100, when persisting through two or three successive uterine contractions, truly signifies danger. Wider disagreement prevails concerning the probable cause of such slowing up and its relation to intra-uterine and postpartum asphyxiation.

Esch, who studied this question very carefully, offers as his opinion that,

contrary to Seitz's belief, the retardation is the expression of a compression of the head, resulting in a vagus irritation, while a vagus paresis, on the other hand, leads to a sudden rise in the fetal heart rate. A slowing might also be caused by an accumulation of carbon dioxid, but unfortunately a clinical differentiation between these two causes is impossible. Rihl and Weinzierl, more recently dealing with this question, agree that an irregularity of fetal heart sounds and particularly retardation below 100 beats is a signal of evident danger but that in this respect also an alteration in pitch or loudness is most significant. When heart sounds incident to change of rate also become less loud, duller and muffled, in their belief, this acoustic change more definitely indicates approaching danger. They admit that this arhythmia might be caused either by excessive compression of the head or by carbon dioxid intoxication. Actual damage to the respiratory center—which in the form of irritation might induce premature inspiration, and in the form of paralysis will later preclude initiation of a normal respiratory function—can be diagnosed only after birth. Incidentally, these writers call attention to the interesting fact that they had observed during labor 3 cases of marked fetal arhythmia which persisted after birth. One of them on electrocardiographic study later was found to be a sinus bradycardia, while the two other cases showed auricular extrasystoles.

Frey very plausibly reasoned that during active labor an abnormal increase of intracranial pressure always, and mechanical interference with cord circulation often, must in some form or another be dependent upon the force of the uterine contractions. So it seemed to him feasible to relieve this pressure temporarily by the administration of narcotics, a suggestion made some time ago by Seitz. Frey prepared a patient for forceps extraction because the fetal heart had slowed down to a seemingly dangerous degree. With the patient in deep anesthesia he realized that delivery at that moment was not possible. Several hours later the patient expelled spontaneously a perfectly fresh, not asphyxiated child. This observation induced him to experiment with the systematic use of chloroform for the purpose of overcoming threatened intrauterine asphyxiation of the fetus. From observations made on 35 cases he concludes that chloroform is indicated if the fetal heart rate remains below 100 for the entire interval between two contractions. If within the next ten to fifteen minutes, with the patient kept under anesthesia, the fetal pulse returns approximately to normal, the administration of the anesthetic can be stopped. Only if the fetal pulse in this time does not slacken considerably the justification for operation is given.

The practical importance of this novel suggestion is shown by the fact that in deliveries, both at home and in hospitals, the assumption of fetal asphyxiation leads to about 70 per cent of all artificial deliveries.

A slowing of heartbeats in the second stage of labor, states Bartram, might mean an accumulation of carbon dioxid. The interference with the required oxygen supply to the fetus might be due to abnormal conditions either in the placenta or in cord circulation, or indicate as well an existing intracranial hypertension. If the hypertension is caused by an intracranial hemorrhage,

operative delivery obviously will fail to bring help; if due solely to excessive molding, relief from the dangerous outside pressure certainly would be desirable but, unfortunately, application of the forceps and extraction will actually augment this pressure and the operation result in more harm than good.

Frey's suggestion has been extensively tested in various German clinics. Waller used chloroform in 80 of a total of 180 cases of fetal arhythmia during labor. The result was entirely satisfactory in almost 69 per cent. Heart action became perfectly normal, though in 8 cases these inhalations had to be repeated. It was found that in some of the unsuccessful cases there evidently existed a combination of excessive skull compression with mechanical obstruction in cord circulation, the latter condition naturally not being necessarily relieved by the administration of chloroform. Waller feels certain that none of the babies was in any way harmed by the chloroform but emphasizes that the anesthetic must be properly given, only a few inhalations to inhibit temporarily uterine activity but not sufficient to produce a surgical anesthesia. Willkomm is convinced of the value of the method as a preventive of serious intra-uterine asphyxiation. Schumacher claims that in patients in whom the administration of chloroform is objectionable, equally good results can be achieved with ether. He used ether in 37 cases with a perfect result in over 75 per cent of them. In 6 cases renewed retardation of heart sounds finally forced him to apply forceps but he emphasizes, as other authors had done before, that even only temporary effect of such inhalations has its definite advantage since often much valuable time is gained. Labor will have progressed in the meantime sufficiently to permit application of forceps under decidedly more favorable conditions. The ether should be given in high concentration on the Juillard mask. Beneficial effect will then be noticeable within about two or three minutes.

In this connection a very instructive case reported by Cohen shall be mentioned. With membranes still intact, in the first stage of labor, a serious brain injury was suspected on account of striking fluctuations in the fetal heart rate, varying between 80 and 170. At this time the head was only forcibly pushed against the pelvic inlet and had not yet entered the pelvis. Chloroform seemed to yield some temporary improvement. Later, with membranes ruptured and head deep in the pelvis, the heart rate remained more steady for about three hours. The baby at birth seemed only slightly asphyxiated but considerable difficulty was experienced in making it cry. About fourteen hours later the infant became cyanotic, followed by typical Cheyne-Stokes respiration; later convulsions started and exitus occurred thirty-four hours postpartum. Autopsy showed no visible damage to tentorium or brain, but on microscopic investigations multiple minute hemorrhages and other changes so well described by Schwartz were discovered.

As already mentioned, some writers have always maintained that asphyxiation can be directly responsible particularly for smaller hemorrhages in brain and meninges (Seitz, Zangemeister, Stern, etc.). Thus naturally the idea developed that seemingly impaired fetal heart action, for the very purpose of preventing intracranial hemorrhages, should be improved by the administration

of cardiac stimulants given to the mother in the expectation that they will pass through the placenta to the fetus and affect as well his heart. Hofbauer (in 1911) had employed digitalis and his favorable results were confirmed by Boose (Inaugural Dissertation, Marburg, 1924). More recently Poeck followed this same principle and now claims eminently satisfactory results with newer preparations (hexeton, cardiazol). In 39 cases, in which intra-uterine asphyxiation was diagnosed on the basis of change in heart rate, after the administration of one of these cardiac stimulants 37 living babies were obtained.

Dollinger, in discussing the often insurmountable difficulties in arriving at a definite diagnosis of intracranial injury of the newborn, states that it is characteristic for early infancy, and especially in regard to affections of the central nervous system, that identical causes may produce quite different symptoms, while again symptoms quite identical might arise from entirely different causes. In general one might differentiate between a very evident "large picture" of intracranial damage and the less distinct "minor picture." The large picture comprises a mixture of alarming signs of exaggerated irritation or again of marked paralysis of various muscle groups and, as a rule, includes some impairment of the respiratory function. There is a rapid aggravation of these symptoms and usually the fatal end is soon reached. In contrast to this stands the ever puzzling minor picture. It often is devoid of any striking or disturbing signs. The condition shows no very marked progression. The various deviations from normal, described in preceding pages, are by themselves not characteristic; as a matter of fact they are often discovered only by very careful observation or special tests, and their proper interpretation is difficult. Some of the babies finally die—apparently succumbing to prematurity, debility, inanition, nutritional disturbances, etc.—if a complete autopsy does not reveal the true cause of death. The majority of slightly traumatized babies, however, recover and then either remain well or only later in life manifest the true meaning of certain insignificant symptoms at birth by turning out to be physically or mentally defective.

The complexity of the diversified lesions within and on the surface of the brain, produced by the traumatism of molding, their usual multiplicity, peculiar distribution and wide variation as to size of the resulting hematoma, all these many factors explain why it is impossible to evolve a definite picture of the symptomatology of intracranial birth hemorrhages; why in the greatest majority of instances the lesion cannot be satisfactorily localized even when certain clinical manifestations or findings establish its existence. Cameron, Capon, Henkel, Holland, and others deal with the early general symptomatology which by now is well known—anomalies of respiration, cyanosis, inability to suckle, twitching, convulsions, paralysis, bulging of fontanels, separation of sutures, etc.—but they are unable to offer any new helpful suggestions in regard to better evaluation and interpretation of such findings.

Various procedures have lately been suggested as useful aids in this admittedly difficult diagnosis of intracranial hemorrhage.

The long appreciated help of a spinal puncture in the diagnosis of intracephalic hemorrhage is emphasized or, as I feel, overemphasized by Sharpe and

Maclaire in several papers. The mere presence of blood in the spinal puncture fluid can hardly be accepted as proof positive of an intracranial hemorrhage, and a recognized authority on spinal fluid, Levinson, quite recently wrote: "Obtaining bloody fluid is possibly the most frequent mishap in spinal puncture. It happens to both the inexperienced and the experienced. The blood is due to injury produced to the plexus of veins in the canal."

Many newer contributions deal with this same problem and undeniably in general express views not entirely coinciding with Sharpe's extremely favorable opinion. Grulee emphasizes the fact that for the purpose of making a spinal puncture the infant is held in a cramped position which definitely produces a venous congestion and thus actually favors further hemorrhage. In his opinion technical difficulties of the procedure are generally underrated and the actual outcome of such a puncture is questionable for the majority of cases. Sanford has shown how extremely rich the venous plexuses within the spinal canal are just at this early age, when vertebral bodies practically are venous sinuses.

Obviously various suggestions have been made to differentiate the actually bloody from the merely contaminated spinal fluid, for instance, to collect the escaping fluid successively in three tubes. The unreliability even of such precaution is well illustrated in an observation recorded by Balard. The first tube contained pure, seemingly fresh blood, the second tube perfectly clear, normal spinal fluid. The baby died soon afterwards and autopsy established a large meningeal hemorrhage. Roberts details his findings in lumbar punctures done on 423 newborn infants without regard to character of labor or condition of the child. No ill effects were noticed in any case. There was rarely a fluid which did not contain an occasional red cell. All fluids showed some degree of discoloration from straw color to deep yellow, though in no instance the baby at the time showed any evidence of jaundice. He considers it a simple matter to distinguish between accidental contamination and blood actually present in the spinal canal. The former invariably streaks the spinal fluid, while the latter always yields a uniformly bloody fluid. The just quoted case of Balard certainly proves that conditions not always are so clear and simple, and thus one might be justified in doubting the correctness of some of Roberts's conclusions, *e.g.*, that the presence of macroscopic blood, not caused by the puncture, proves an incidence of 14.1 per cent (60 cases) of intracranial hemorrhages in his series. He believes to have proved that in 34 of them, perfectly normal infants, lumbar puncture beyond doubt established the presence of intracranial hemorrhage which never could have otherwise been suspected. It might be stated that there were only 4 autopsies in this large series to prove the diagnosis and that all the infants were born to negro women, of whom 14.5 per cent showed a positive Wassermann reaction.

Giving an accurate description of a proper technic of spinal and cisternal puncture, Levinson, Greengard and Lifvendahl emphasize the advantages of the cistern puncture over the less reliable and often misleading spinal tap. In all instances of suspected cerebral hemorrhage, with lumbar tap being found dry, Dunham for the past two years has resorted to the puncture of the cis-

terna. This puncture approaches closer the seat of the suspected hematoma and but rarely causes accidental contamination with blood. Wohlwill, arguing against Sharpe and Maclaire, maintains that neither a yellowish spinal fluid nor one actually containing blood (not due to the puncture) really proves the existence of an intracranial hemorrhage because this blood might come from a minor and entirely unimportant hemorrhage anywhere in the long spinal canal. Furthermore, even in severe supratentorial hemorrhages or in those within the substance of the brain, the spinal fluid will be found perfectly clear, if the hematoma does not drain into a ventricle or the subarachnoidal space. Therefore, neither positive nor negative findings in the various series studied by Sharpe, Maclaire or Roberts give us a clew in regard to the actual frequency of intracranial traumatic lesions.

Out of this entire literature I consider but one fact of special significance. Spinal punctures made by Ullrich on 100 infants, born either after definitely difficult labors or immediately offering some symptoms suggestive of intracranial traumatization, yielded a sanguinolent fluid in 15 babies. Four of them died within the first few weeks of life. Of the remaining 11, 8 were observed from eight to eleven months. They remained seemingly well and developed normally.

It might be doubted that a seemingly increased pressure of the spinal fluid, ascertained at the time of puncture, is of any great value for the diagnosis of increased intracranial pressure due to hemorrhage. It so happens that I discussed this very point with Baranyi and he assured me, as have other experienced pediatricians, that the outcome of the measurement of this pressure is so greatly dependent upon the position of the baby at the time of the puncture, upon the character of respiration, and is so markedly influenced by crying, that the actual figures obtained in this manner are practically void of any real meaning. Levinson, Greengard and Lifvendahl admit that spinal pressure readings above 6 Mm. Hg speak for the presence of some pathologic change but deny that they can be accepted, as done by Sharpe and Maclaire, as positive indications of a cerebral hemorrhage.

We are willing to concede that spinal puncture conditionally is useful for diagnostic purposes. Since the procedure seemingly is associated with very little risk it might be routinely employed in all suspected cases, but extreme caution must be exerted in the interpretation of the findings.

Dandy's encephalography and the more recently developed myelography promise in the near future to develop into very valuable aids of diagnosis of intracephalic birth lesions. Encephalography with injection of air through either lumbar, cisternal or ventricular punctures is now being used with satisfaction in clearing up later sequelæ of birth injuries. Foerster describes in detail the findings made in children from 3 to 6 years old, proving in these cases the definite natal origin of later defects. Koeppe finds the method valuable in the differential diagnosis of cerebral disease of young infants, especially by taking an x-ray picture before air inflation for comparison with one taken after the inflation. Similar observations are described by Koschewnikoff and Fraenkel, made on infants less than 2 years old. I will quote one of their

cases to illustrate the possible value of encephalography in our problem. After inflation the x-ray picture showed an unequal subarachnoidal distribution of the air in various parts, particularly in regard to both convexities of the brain. This clearly spoke for some pathologic change of the meninges, presumably the result of some trauma. History revealed that the baby was born spontaneously but later developed twitching of the extremities followed by epileptoid attacks. At the age of 13 months the right half of the skull was noticed to be smaller than the left. There were evident anomalies in motor innervation and a distinct retardation of mental development. Schlossmann, Brehme, Wartenberg and many other writers praise the value of the method and its relative harmlessness even in very young infants, Wartenberg including in this discussion myelography with the injection of lipiodol.

In this connection I shall mention the very ingenious suggestion made for a simple radiographic procedure to diagnose an intracranial hemorrhage as the cause of death in cases in which permission for an autopsy cannot be obtained. Lipiodol has been employed for the purpose but more practical appears to me the method devised by Schoenholz, especially because it does not cause the objectionable discoloration of the baby's face resulting from the injection of lipiodol. As soon as possible after death, a gelatin mixture (red lead oxid 60.0, distilled water 100.0, white prepared chalk 20.0, gelatin 20.0) is injected into the jugular vein, while the body is kept submerged in a warm bath (40° C.) to prevent congealing of the injection fluid. Both jugular veins are exposed and severed, and the mixture by means of a heated syringe injected into one vein towards the head until the red fluid begins to escape from the vein on the other side. Then both ends are ligated and by removal from the warm bath the fluid permitted to congeal. It is obvious that not too much pressure must be used to prevent artefacts by forceful rupture of small veins. The article of Schoenholz contains some beautiful radiographs which prove his contention that this postmortem procedure not only permits the definite diagnosis of intracranial hemorrhages but in stereoscopic pictures as well shows their actual location.

The problem of immediate diagnosis is further complicated by the fact that symptoms, even of evident hemorrhage, may not appear until much later. A somewhat extreme but most instructive observation of this sort is recorded by Schele. This baby died rather unexpectedly when 6 weeks old. Autopsy showed a large subdural hemorrhage from a deep tentorial tear. Since this baby, to Schele's best knowledge, had not sustained a head trauma since birth, he assumed that a small tear, occurring at birth, did not heal properly, possibly as the result of an intercurrent acute febrile condition, and later reopened and further extended into the sinus transversus.

The delayed appearance of the signs of hemorrhage in some cases undoubtedly is due to persistence of a slight hemorrhage from a small vessel on account of the inability of the blood to coagulate properly. However, it is not justifiable to claim, as recently done by Kaiser, that a hemorrhagic diathesis often is the direct and sole cause of an intracephalic hemorrhage of the newborn. I take issue with Munro and Eustis for classifying hemorrhagic diathesis as one

of the immediate etiologic factors in their grouping of the causes of cranial hemorrhages, and Conkey also feels that at present the hemorrhagic disease theory is overstressed to the exclusion of the causative mechanical and traumatic factors. It is true that Cruickshank, in his report of an analysis of the pathologic findings in 400 newborn infants, assigns first place to hemorrhagic disease as the chief cause of hemorrhages, but it should not be overlooked by writers quoting him that he speaks of all types of hemorrhages in the various tissues and organs of the newborn infant.

An interesting contribution recently published by Moore and Brodie shall here be mentioned, in which they refer to the fact that experiments on animals had demonstrated that an artificial avitaminosis of the pregnant animal might become the cause of abnormal hemorrhages seen in the newborn. They quote the history of a woman whose prenatal diet was markedly deficient in vitamin B. Her spontaneously born baby of 7½ pounds died a few days postpartum. Autopsy showed hemorrhages from suprarenal glands and kidneys. An etiologic relation of this hemorrhagic condition to the deficient diet, in their belief, might be justly assumed.

I think that another recent finding should prove of great practical interest to the obstetrician in regard to the problem of delayed appearance of the first signs of an intracranial hemorrhage. Sanford investigated the effect of gaseous anesthetics, commonly employed in labor, on the blood of the infant. He found that both nitrous oxid and ethylene lengthen coagulation and bleeding time, this effect being more marked in ethylene which prolongs the bleeding time by two minutes and coagulation by three minutes.

In my belief, the primarily traumatic origin of intracranial birth lesions now has been definitely established by the comparative studies of Schwartz on the brains of newborn infants and of newborn animals with hard skulls and no fontanels, mentioned in foregoing pages, and furthermore is convincingly demonstrated by all recent information concerning the high frequency of such injuries in breech labors, as well as in prematurely born infants.

Cruickshank offers the following figures: In 47 per cent of mature and 52 per cent of premature infants, in whom a tentorial tear was discovered at necropsy, a breech delivery had taken place. Of 81 infants with dural injuries, reported in Holland's series of 167 fetuses, 35 were either breech or version cases. In another paper Holland states that tentorial tears occur in 88 per cent of dead fetuses after breech labors, a figure given also by Crothers. In Saenger's belief no mechanism of labor is as dangerous to the child as the delivery of the after-coming head. Of 23 children delivered in this manner, who came to autopsy, only 3 failed to show tentorial tears.

This high incidence of fatal intracranial lesions in breech labors can be plausibly explained only by decidedly unfavorable, mechanical factors inherent to the abnormal mechanism in the delivery of the head (Capon, Crothers, Greenwood, Jaschke, Saenger), though admittedly the risk is increased by undue haste during extraction of the head as emphasized by Holland, Pierson, myself, and others.

The immediate dependence of intracranial injuries upon birth trauma,

however, probably is yet more convincingly shown by the fact that the ratio of their frequency and particularly the degree of their seriousness are directly proportionate to the stage of prematurity. Beyond question the skull bones represent the protective factor of greatest importance. Hard-skulled full-term infants are less exposed to the damage of excessive external trauma and of exaggerated molding. This latter fact was well illustrated in one of my cases.

The shape of the soft and elastic cranium of the premature infant is easily and often quickly altered to a dangerous and disastrous degree. The obstetrician must never forget that this exaggerated configuration, as definitely established by careful observations, can be effected also by the soft portions of the birth channel (Vogel), by a not completely dilated cervix, a rigid perineum, or a narrow vulval ring. This accident is particularly prone to occur when fast expulsion takes place, that is, in labors which, to the satisfaction of the mothers, are easy and quick.

Raisz discovered in 81 autopsies of full-term newborns, exactly as in the 42 autopsies of premature infants, signs of intracranial hemorrhage in 33.3 per cent; when he, however, considered the number of instances in which such a hemorrhage actually was responsible for death, he found among the full-term infants fatal hemorrhages only in 5.12 per cent, but in 23.8 per cent of the premature infants.

Possibly of some significance for our problem is the recent observation of Reis that the greatest increase in the blood-pressure of newborn babies can be ascertained in those delivered by means of a midplane forceps or version extraction, with a lesser degree of elevation after the application of only a low forceps. He concludes that this increase of blood-pressure seemingly is due to an increased traumatization of the head. Though this rise in blood-pressure is not strikingly large, it might present some factor in the causation of hemorrhages and particularly in premature babies. Also Rucker and Cornell claim that the systolic pressure of the newborn is considerably increased by a birth trauma.

A factor of great weight, however, is the evident fragility of the blood-vessels in premature infants. Two newer contributions of Ylppoe must be mentioned in this connection. Hemorrhages of various kinds represent a characteristic difference in the clinical pathology of the young infant as compared with the adult. Ylppoe experimentally produced skin hemorrhages by creating a negative pressure by means of a suction bulb. In this manner he ascertained that in infants, weighing less than 1000 Gm., a pressure of 150 Mm. Hg is sufficient to cause hemorrhage owing to the rupture of vessels. At a weight between 2000 and 2500 Gm. the required pressure was 400 Mm. Hg, while in infants of 3000 Gm. and above, this negative pressure had to be raised to 520 Mm. Hg to cause hemorrhage. These findings, at least in part, would explain hemorrhages in the premature infant, if we take into consideration the fact that the average of normal pressure in delivery at 250 Mm. Hg for small premature infants actually transgresses the resistance of their blood-vessels. This theoretical deduction he was able to establish as correct in another series of observations in which he demonstrated an inverse ratio of the

frequency of brain hemorrhages to the degree of development. He found brain hemorrhages in 90 per cent of infants weighing less than 1000 Gm., in 76.5 per cent weighing between 1000 and 1500 Gm., in 35.3 per cent of those between 1500 and 2000 Gm., and in 26.7 per cent weighing between 2000 and 2500 Gm. He feels certain that the further development of a premature infant is actually determined in the main by two factors, by its birth weight and by the degree of its traumatization in birth. Among premature infants, later in life, appear with striking frequency pathologic conditions, which are clearly referable to the central nervous system, and especially anomalies of intelligence.

All newer literature (Dollinger, Jaschke, etc.) reflects this conviction of a particular vulnerability of the prematurely born child. Of course, as has been demonstrated by Keller in an investigation of the later life of premature infants, in this respect the special cause which led to the premature start of labor (disease of mother) plays an important rôle. Interesting in this connection is syphilis, which occasionally is mentioned as a possible direct cause of intracranial hemorrhage. Voron and Pigeaud report 3 newborn, syphilitic infants dying from intracranial hemorrhage. Since labor in all three instances was uncomplicated and spontaneous they feel justified in excluding birth trauma as cause of the hemorrhage. One can hardly agree with this deduction. It seems more likely that a certain degree of prematurity together with possible vessel changes due to syphilis rendered these three infants particularly vulnerable and thus fully explain their fatal traumatization in spontaneous labors. Indeed, in my belief, it would be more logical to deduce from these three cases that even in evidently syphilitic babies the positive diagnosis of syphilis as actual cause of death can be made only after an autopsy has proved brain and meninges undamaged.

In a large series of premature babies which Ylppoe was able to follow for a longer time there were 7 to 8 per cent of imbeciles and idiots, 3 per cent of whom alone developed a typical Little's disease. He calculates that 40 per cent of premature infants, which had supposedly spasmophilic convulsions in the first and second year of life, later manifested evidences of cerebral defects of varying degrees, very often expressed as deficiency of mentality.

This brings us to the discussion of the complex problem of immediate and late consequences of intracranial birth damage. The following obvious, physiologic facts are emphasized by Crothers: (1) The baby must have an excitable medulla and an intact upper spinal cord to be able to initiate respiration; (2) damage below the phrenic nuclei and above the medulla can be extensive without immediately threatening the life of the child, however much it may interfere with normal physical and mental efficiency later; (3) injury or even extensive hemorrhage within the craniovertebral cavity does not necessarily injure the tissue of the brain or cord.

A further point, which justifies the hope for recovery even in the face of apparently desperate lesions, is the fact that the infant's nervous system consists of practically fetal type of cells. Cells of this sort survive damage which would prove fatal to adult cells.

Therefore, according to Crothers, if birth injuries are recognized in the

first hours of life, it is legitimate to attempt to save life, even if the lesion has apparently compromised the future severely. It is also reasonable to refuse to acknowledge that irreparable damage has been done until pessimism is justified by time. Various periods of time have been set but such definite schedules seemingly are worthless.

It seemed appropriate to me to present Crothers' opinions, based on extensive clinical study, before beginning with quotations from the extensive and somewhat contradictory literature which is rapidly accumulating on this special and most important aspect of cranial birth trauma.

Personally I have come to the conclusion that further confusion can be prevented only by an attempt to differentiate as clearly as would be possible, between a physiologic and a pathologic birth trauma to the child, exactly as we are doing in regard to the traumatization of the mother in birth. Within certain limits we accept lacerations of the cervix, vaginal walls and perineal structures as physiologic. In the light of the investigations of Philip Schwartz and his many collaborators we must admit that labor causes more or less typical anatomic alterations in the brain which, however, in the overwhelming majority of instances are and remain physiologic. At least we must designate them as physiologic as long as they do not lead to any definitely pathologic consequences. Jaschke, as the one obstetrician standing up against the onslaught of pathologists, pediatricians and neurologists at the Düsseldorf meeting, most aptly asserts that however valuable and interesting Schwartz's findings are, there still does not seem to exist any justification to regard birth as a catastrophe. Buengeler at that occasion spoke of the "birth crisis." The marked pessimism noticeable in the literature of the past few years certainly is not legitimate but is based on the discovery of the fact that some traumatic natal change in the brain is rather the rule than the exception. If most of us, and probably all of us who are firstborn children, have sustained some cerebral damage in birth, surely most of us still enjoy the possession of an able body and a normally working mind.

One can easily understand how this unsuspected discovery of an almost typical effect of labor on the brain led to the present tendency of connecting almost any deficiency in later physical or mental development with one of the various known types of possible cerebral birth lesions.

There can be no doubt that in a certain number of instances the damage is clearly pathologic and then either causes immediate death or a subsequent defect.

Recent literature contains many contributions which actually prove or strongly suggest such a direct connection. This problem, outside of Schwartz and his collaborators mentioned in foregoing pages, is thoroughly discussed also by Cameron and Osman, Gordon, Hamill, and others. Stroehm, Ceelen, Schwartz, and Siegmund deny the existence of an encephalitis interstitialis of young infants as first described by Virchow. Burhans and Gerstenberger confirm the assertion of Rosenberg or Finkelstein that an internal hemorrhagic pachymeningitis in early infancy is more common than is generally believed. They feel certain that in some infants a subacute pachymeningitis originally

resulting from a birth hemorrhage, later is rendered acute by some further physical injury.

Salge-Mendelssohn claims that there are two distinct types of hemorrhagic pachymeningitis found in young infants, the one due to a progressive proliferation of connective tissue and capillaries, while the other arises from a subdural hemorrhage caused by a birth trauma. This latter type, which is comparatively mild and, as a rule, only accidentally discovered at autopsy, is usually well localized and shows no tendency of progression. It is for this reason by some writers termed as the traumatic regressive form of pachymeningitis.

An even slight intracranial hemorrhage, in the opinion of Dollinger, might represent or create a locus minoris resistentiæ for inflammatory, toxic or bacterial noxæ, thus possibly only later in life becoming responsible for the appearance of pathologic manifestations. Ylppoe and also Lindberg (in 1917) had suspected an etiologic relation of birth injury to epidemic spinal meningitis. Dollinger very recently observed two instances of this disease in infants only a few weeks old. Both had been born by artificial means and died less than a year old as hydrocephalic idiots. Bischoff and Breckenfeld reported the case of an infant which, suffering from spasms since birth, died 3½ months old from a proteus meningitis. At necropsy the typical residua of a subdural hematoma were discovered. Mention must be made in this connection of a report of Muntendam. A child delivered by means of a very difficult forceps extraction died at the age of 4 months of a tuberculous meningitis. In discussing the problem of meningitis in the newborn, Karplus emphasizes certain difficulties of diagnosis in part due to anatomic peculiarities of the skull. Such symptoms as listlessness, exaggerated or reduced sensibility, changes in facial expression, etc., in newborn babies are prone to manifest themselves strikingly late. Just in such cases the lumbar puncture might prove of great diagnostic help. Karplus mentions the obvious fact that the infection might reach the meninges by the blood stream or from a closely lying focus. In this connection lately great stress is laid by writers on the findings of Schwartz, Berberich, Voss and others, demonstrating the high frequency of hemorrhagic lesions in the middle ear of the newborn. Herz thinks that this effect of birth on the os petrosum probably stands in etiologic relation to the certainly not uncommon otitis media of newborn babies, occasionally terminating in a sinus thrombosis, an opinion shared by Thieleman.

It would lead us too far to give here in detail suggestive or convincing evidence of the connection of various organic and functional diseases of the central nervous system to birth trauma, extensively presented in the papers of Crothers, Crothers and Putnam, Dollinger, Ford, Heidler, Schwartz, Zappert and others. A careful perusal of all these contributions and others, still to be mentioned, is indispensable for a clear understanding of this involved problem.

In a study of this literature and especially of reports of individual observations, the obstetrician not so rarely feels unable to share the writers' views in regard to the clearly obstetric features of the case. This is not surprising since particularly the literature on the late consequences of birth trauma is

chiefly supplied by non-obstetricians. The obstetrician, unlike the neurologist, is not convinced that a labor was difficult simply because the mother considered it to have been. The obstetrician will naturally hesitate to receive from a pathologist instruction how labor should be managed. A few examples of such reports, not entirely convincing, will be quoted.

In a case of porencephaly, described by Kikuth, the defect in the writer's belief could not be due to maldevelopment or to any postnatal infection. He therefore feels fully justified in assuming that the underlying cause was a hematoma, originating in labor or possibly in connection with an accident late in pregnancy when the patient had a heavy fall. Babonneix and Duray present before the Pediatric Society in Paris a case of choreo-athetosis in an 11-year-old girl as a birth trauma, because she was delivered by forceps under chloroform after a long labor. Schmal discusses the etiology of microcephaly and acknowledges that its causation is not clear. While some authorities believe in a primary microcephaly due to a disturbed anlage, others favor the theory that the deficient development of the skull is only the result of defective growth of the brain. He even admits the occurrence of a familial type, but reports his 3 cases under the title, "Microcephalic Idiocy as the Result of Traumatic Birth Injury," apparently because these 3 babies had been extracted by means of the forceps. The belief of some writers in a very intimate connection of hydrocephalus with birth damage seems hardly supported, for example, by a report of Desaubry of hydrocephalus in three successive children of the same mother.

A careful analysis of the material of the Johns Hopkins Hospital leads Ford to the conclusion that congenital diplegias, which constitute the largest group of infantile spastic palsies seen, are not to be attributed to meningeal hemorrhages at birth. They are the result of various pathologic processes of intra-uterine origin. He thinks that possibly in some cases a chronic hydrocephalus might result from plugging of the aqueduct by blood, and that, on the other hand, an intracranial hemorrhage is not uncommonly an accidental complication of a congenital hydrocephalus, just because these babies have large heads and thin skulls.

True cerebral birth palsies, in Ford's opinion, are represented by the congenital hemiplegias, monoplegias and the asymmetric bilateral spastic paralysis. Numerically, however, this group is very small, only 17 cases in his material of 280 infantile cerebral palsies. Ford also states that severe grades of mental defects are probably not related to birth injury with the exception of those which develop in connection with frequent convulsions.

An interesting historical outline of gradual change in views concerning the significance of convulsions in early life to later epilepsy can be found in an article by Patrick and Levy. In their own studies they were able to ascertain for 500 cases of idiopathic epilepsy an incidence of early convulsions amounting to probably more than 20 per cent, while in another group of 752 unselected infants and children the frequency of early convulsions amounted only to about 4.2 per cent, about one-fifth that of the epileptic group. Thus they are forced to conclude that the presence of an infantile convulsion *per se*

multiplies the individual's ordinary chances for later epilepsy at least by five. However, there is a preponderating number of but one single infantile convulsion in the non-epileptic group.

A careful analysis of the figures presented by these writers reveals still another fact, seemingly important to the obstetrician though not stressed by them. In the epileptic group I find the incidence of convulsions to be almost twice as large within the first four weeks postpartum, and three times as large within the first five months of life, than in the corresponding ages of the non-epileptic group. If we admit that birth trauma plays a part in the causation of early convulsions, the conclusion suggests itself from these figures that it also might be an etiological factor in the occurrence of epilepsy.

Hempelmann thinks that injuries of the brain which are not promptly fatal are usually followed by the development of a spastic paralysis involving one or more extremities. This condition often is found associated with more or less mental deficiency, incoördination or athetosis. He points to the fact that in contrast to pediatricians some of the neurologists doubt that these lesions are frequently caused by birth traumatization but personally feels that the recent work of Schwartz has supplied tangible evidence for the frequent occurrence of injuries of this sort. Thus some of the most bizarre motor disturbances seen in infants are likely to be due to lesions in the region of the lenticular and caudate nuclei.

Sachs, arguing against Collier's negative attitude in regard to the relation of birth trauma to later deficiencies, concludes that Collier's position is unjustified. While it may not be correct to ascribe all cases of diplegia or hemiplegia to natal hemorrhage, the evidence that such hemorrhages frequently occur is almost overwhelming. There is then no valid reason to simply disregard such evidence in favor of another theory which may be ingenious but is not satisfying.

Grulee doubts that hemorrhage always is the actual cause of such defects since hemorrhage, indeed, might be favored by an existing brain pathology. It seems unlikely to him that every brain hemorrhage necessarily must result in some local degenerative process since, for example, Jacobs has shown for retinal hemorrhages that they almost invariably are quickly resorbed without any after-effects.

Logically Neugarten reasoned that if there exists a close relation of birth traumatization to later development, such unfavorable consequences should be particularly noticeable in the children of eclamptic mothers. These infants more than usually are exposed in birth to a multiplicity of possible damage by a long anesthesia, venesection and toxemia of mother, asphyxiation and by an usually artificial mode of forced delivery. Previous investigations of Hannes seemed to show that difficulty of labor and asphyxiation by themselves do not predispose infants to anomalous physical or mental development. The one weak point in Hannes' statistics, however, is the fact that he does not properly evaluate the deaths occurring within the first year of life. At the time of his investigation Hannes found that of the asphyxiated infants 42 per cent had died (36 per cent within the first year postpartum), while in the

fresh born the total mortality amounted only to 25 per cent (with 18 per cent within the first year). This after all means that within the first year twice as many of the asphyxiated babies died than of the fresh born.

In Neugarten's series of 123 eclampsias, 35.2 per cent of the babies were stillborn. Of the 81 surviving infants the fate of 30 could be later determined. Six of them had died from various diseases within a little less than three years postpartum. The remaining 24, with but one exception, showed no deviation from normal. The slight mental retardation in the one case could more plausibly be ascribed to prematurity, the infant weighing at birth only 1500 Gm. Similar investigations yielding almost identical results had previously been made by Reuss and also Weber. Even an unusually large risk at birth, according to Neugarten, in general evidences no marked deleterious effect in later physical and mental development.

Heidler in his detailed, critical analysis of a large series of cases, in many individual instances shows how later defects seem satisfactorily explained by other factors but is willing to admit, at least for two of his cases, that occasionally the causative relation of defect to birth injury can be clearly established.

From the viewpoint of the obstetrician the paper of Zappert easily ranks among the most pessimistic. In it the deliberate attempt is made to link practically every known type of anomaly of the central nervous system with some particular form of possible intracranial birth lesion. "While ready to warn against too far-reaching deductions from newly established facts," concludes Zappert, "I am ready to proclaim that Ph. Schwartz's findings represent the most valuable recent contribution to infant neurology. A thorough revision of our teaching of brain diseases of the nursling has become necessary. . . . The repetition of the same defect in several children of the same mother, suggesting a familial type of the disease, is possibly due solely to the frequency of this particular type of birth injury."

Very few writers seem willing to accept such extreme views. We might acknowledge that these newly discovered anatomic facts throw additional light on the generally mysterious and puzzling etiology of various anomalies of development. Traumatic lesions sustained in birth certainly are of considerable etiologic significance in some conditions but there is no justification for the belief that all types of deficiencies can now be reliably traced back to this one cause.

No truly new suggestions have been offered of late concerning the treatment of cerebral hemorrhages of the newborn. As far as simplicity and usefulness are concerned, lumbar puncture, repeated if necessary several times, remains in the forefront. This procedure is most enthusiastically supported, especially by Sharpe. Brady, who several years ago strongly advocated this simple and fairly safe operation, later detailed a case in which he performed with perfect success a puncture of the cisterna magna. In his opinion this high puncture should be done whenever, in the presence of an evident hemorrhage, the customary spinal puncture fails to withdraw blood. In this manner it might be possible to save babies who heretofore have been lost owing to dry

taps on lumbar puncture. His own case probably is the first one on record of seemingly complete recovery after a cisternal puncture for cerebral hemorrhage.

Dunham made twenty-seven cisternal punctures on 10 newborn infants, from one to eight punctures in the individual case. Six of the babies recovered and are well at the ages between 9 and 24 months, and with the exception of one their mental condition seems normal. In each instance the favorable immediate effect was marked. He highly recommends the cisternal puncture as of great therapeutic value, a fact now generally acknowledged by pediatricians.

Sharpe and Maclaire, Comby, Riviere and Riviere, Velasco, Paperini and others praise the efficiency of repeated spinal punctures, Comby advocating a simultaneous intraspinal injection of horse serum and subcutaneous introduction of some other hemostatic preparation (gelatin is favored by Velasco and Paperini). Dollinger asks the reasonable question whether lowering of intracranial or intraspinal pressure might not favor further hemorrhage. This same point is also made by Grulee who considers repeated withdrawal of fluid blood as disadvantageous from this viewpoint, while, of course, clotted blood could not be aspirated at all. He feels that probably the best one can do for the injured baby is to disturb it as little as possible.

The acknowledged etiologic significance of an anomaly in the coagulability of the fetal blood is fully taken into account in the practice, probably to-day a routine in most obstetric clinics, of giving to every infant which exhibits symptoms even only suggestive of hemorrhage, prophylactically a subcutaneous injection of from 10 to 30 c.c. of the father's or mother's blood. Falls prefers citrated blood injected into the jugular vein. Grob more recently found that 10 c.c. of blood have practically no effect on coagulation and bleeding time, so that at least 20 c.c. should be administered. Reference already has been made to the possible effect of an avitaminosis and of gas anesthesia during labor on the coagulability of the infant's blood.

New information concerning the anatomic character of such cerebral and meningeal lesions, their usual multiplicity, the impossibility of determining their location, etc., certainly have of late greatly discouraged surgeons from undertaking serious operations for checking the hemorrhage or removing larger clots. Surgical interference, however, still is justified in cases of evident fracture and depression of skull bones.

Ballance and Ballance advocate prompt operation in all cases of skull fracture "not only to obviate impending death but as well, in case of recovery, to anticipate and prevent paralysis, amentia, or epilepsy." It is their belief that infants bear these operations well if they are carried out with greatest gentleness and with every effort to prevent the loss of blood.

Of special interest to the obstetrician necessarily prove recent contributions dealing with the problem of prevention of intracranial damage in birth.

At present the view prevails that the main factor in the causation of tears in the dural septa is the trauma of exaggerated or rapid compression of the fetal head. Of only secondary, though admittedly considerable, importance in the origin of hemorrhages are: Distention of blood-vessels or sinuses owing

to asphyxia; the fragility of the vessel walls in the premature infant, and a hemorrhagic diathesis which favors the gradual escape of a large quantity of blood even from small vessels. More recently, and chiefly through the work of Schwartz, multiple hemorrhages and degenerative processes within the brain substance have been brought into immediate etiologic relation to certain circulatory changes, hyperemia or anemia, both the result either of vasomotor disturbances or of an uneven blood distribution, due to the suction effect exerted by the lower outer atmospheric pressure on the portion of the head exposed within the area of the dilated cervix.

A clear conception of all these various causative factors enables us to develop certain rules for an effective prophylaxis.

We should not make use of an artificial method of delivery which tends to increase further an already existing cranial stress in a certain direction. This point is very lucidly set forth in the paper of Greenwood already mentioned: "Forceps will increase the danger to the child if it increases compression of an already compressed diameter. Forceps may be to the good, if it compresses a diameter compensatorily lengthened by the molding, thus actually affording relief of tension on the septa." Theoretically, at least, it then would seem reasonable that the application of the forceps in a direction approaching the anteroposterior diameters of the head would imply not only less risk but might be a means of reducing the anteroposterior strain. On the other hand, from this same viewpoint, forceps would seem especially risky in brow and occipitoposterior presentations, and also on the after-coming head, because under these conditions the forceps very likely would tend to increase further the already present vertical elongation of the cranium, which proves so particularly dangerous to the tentorium. Therefore, no means should be spared in the effort to obtain better flexion of the partially extended head, to change an occipitoposterior into an anterior presentation, or, as I wish to emphasize, to obviate a breech labor by external version, approximately six weeks before labor.

The particular usefulness of the Kielland forceps for rotating the head is stressed by Saenger, who failed to discover an intracranial hemorrhage in any of his own cases where this forceps alone had been employed.

In the meantime, Heidler's report has appeared which mentions 37 instances of tentorial tears after extractions with the Kielland forceps. He himself emphasizes that it is not so important just what model of forceps is employed though the Kielland permits the more favorable biparietal application. The deciding factor remains how the operation is or can be done. However, it is not surprising that such lacerations also have been recorded after the use of the Kielland forceps since as a matter of fact they do occur in spontaneous labors of women with perfectly normal pelves.

The stress, due to vertical elevation of the cranium of the after-coming head during a breech delivery, can be relieved by pressure on the head from above which not only reduces required traction from below but also produces and maintains better flexion of the head. This latter important effect, in my belief, too often is not sufficiently appreciated. Appropriate help on the part

of the assistant, who exerts this suprapubic pressure, implies the necessity that the direction of this pressure be not straight downward but always oblique, either from the left or the right according to the position of the occiput. This suprapubic force, especially during a uterine contraction, or when combined with traction from below, as shown by Crothers, must not be too strong, since otherwise collapse. or death of the infant might result from the resulting herniation of the medulla through the foramen magnum. This probably explains a fact first noted, I think, by Saenger and now again emphasized by Heidler. This pressure from above, if exerted with full force by an assistant, undeniably may become directly responsible for severe intracranial hemorrhage and, therefore, it is preferable to teach that the operator himself press with one hand from above against the after-coming head. But, as well known, extensive tentorial tears are found even after entirely spontaneous expulsion of the head in breech labors. Instructive in this connection will prove a case of Heidler, in which the cord had prolapsed. Death was thought to be due to asphyxiation but, as a matter of fact, was found to have been caused by bilateral tentorial tears, presumably the result of haste with the extraction in the effort to prevent asphyxiation.

A prophylactic spinal puncture in breech labors for the purpose of reducing the size of the after-coming head has been recommended several years ago. Costa applied this measure in 10 cases, 7 times because the cervix was not fully dilated and in 3 cases of contracted pelvis, and saved all the babies. He considers such a spinal tap of great advantage in breech labors because it reduces the size of the head and thus markedly diminishes the chances for dura tears and as well lessens the pressure against the centers of circulation and respiration.

The evident fragility of the blood-vessels in the premature infant makes it necessary to refrain from all medication or operative measures which hasten the passage of the child through not fully dilated soft portions of the birth canal in all premature labors.

This vulnerability of the premature baby is now recognized as the important, if not principal, factor in the notoriously high infant mortality and morbidity of premature labors employed as therapeutic measures in various complications. In view of our present definite knowledge that the premature infant is particularly prone to sustain serious intracranial damage, Stern thinks that premature interruption of pregnancy certainly has no longer a place in the effort of the obstetrician to prevent such injuries. In the presence of a cephalopelvic disproportion the Walker position must be tried and, if necessary, labor terminated by means of a pubiotomy or cesarean section. Neither prophylactic version nor premature start of labor will prove particularly useful in the interest of the baby. As far as possible there should be no interference whatever with natural labor. In case of primary inertia one of the oxytocics might be administered but only with extreme caution. Difficulty with the soft parts is overcome with metreurysis, cervical incisions or a deep episiotomy. If the head is actually on the pelvic floor for more than two hours forceps should be applied.

Some of the Continental writers criticize an evident abuse of cesarean section by American obstetricians in the exaggerated fear of cerebral damage.

More perplexing from the standpoint of prevention prove the risks inherent in unequal distribution of the blood within sinuses and vessels, expressing itself in either localized anemia or congestion. This latter condition obviously also is closely connected with general asphyxiation of the fetus, another element in the causation of hemorrhages. It might be well to remember what either Heidler or Crothers have to say in this respect, their opinions being based on a painstaking analysis of unusually large series of cases. Heidler states: "Larger hemorrhages can never be the result merely of suffocation." And Crothers: "I believe there is nothing in the very voluminous literature on the subject which contains valid evidence to prove that suffocation is so serious a threat to the infant during delivery that many of the radical procedures aimed at rapid delivery are justified."

Must we try to overcome seemingly excessive or long-continued compression of the head by a forceps extraction as soon or even before we notice certain symptoms which supposedly indicate beginning asphyxiation? Gamper reminds us that to-day every obstetrician very naturally will endeavor to find the answer to the question: Is intracranial damage more often the result of failure to use forceps at the proper time or the direct result of their application?

Personally I have come to the conclusion that a definite answer to this question never can be formulated. In the light of our present knowledge concerning late effects of cranial birth lesions it is entirely illogical to gauge the risk of the forceps extraction or of any other obstetrical operation solely by fetal mortality statistics. Furthermore, the specific restriction of the application of the forceps at "the proper time," neither too early nor too late, actually is void of any real meaning, because it leaves the decision as to the propriety of the time unavoidably to the judgment of the operator. That this judgment, even among recognized experts, varies within very wide limits is clearly seen in the statistics from different large obstetric clinics. A calculation of the danger of forceps extraction from such really imcomparable statistics carries no conviction, as pointed out by Gamper. If one simply compares the forceps frequency of a certain clinic with its neonatal mortality, support is found for the view of Heinlein that in general there probably exists an optimum of forceps frequency which lies between 2 and 3 per cent of all deliveries. It seems that a higher rate of forceps application often is associated with a higher fetal mortality.

A very recent investigation by Pritzi along identical lines calculates the forceps optimum at 3.5 per cent, of course for hospital work, since all obstetric operations in private homes inevitably show a higher mortality and morbidity both for mother and infant. He finds from an analysis of stillbirths occurring in the Frauenklinik in Vienna that only a very few of all the babies lost in labor could possibly have been saved by a forceps extraction. A study of 37,643 deliveries presented by Thurn-Rumbach reveals a total infant mortality (only macerated fetuses are excluded, but all deaths within the first seven days are included) of 4.01 per cent. Forceps extractions (made in 2.31

per cent of all cases) showed a total infant mortality of 7.69 per cent. Even a more restricted use of the forceps fails to show any unfavorable effect on fetal mortality. Santner offers the following figures from the Frauenklinik in Graz: In a total of 21,140 deliveries, forceps were applied in only 0.82 per cent of the cases with a total fetal mortality of 2.37 per cent, which is a lower mortality than in any other reported large series with higher forceps incidence. "We believe," he writes, "that careful preservation of physiologic and normal action of the natural forces results in the best and safest form of delivery. If they seem insufficient we first try to strengthen and support them, and only if we fail in this endeavor, or if other threatening signs force interference, only then we resort to instruments or other artificial means."

We must recall in this connection certain measures I have mentioned in preceding pages, which at least temporarily relieve the symptoms of seeming asphyxiation of the fetus. In many instances, by such means valuable time is gained and progress in labor in the meantime has created conditions decidedly more favorable for the application of the forceps. One can readily agree with Esch: "If excessive compression of the head is considered responsible for the signs of fetal asphyxiation further compression by a forceps extraction necessarily must prove detrimental to the infant."

No one familiar with the problem of cranial traumatization in birth can fail to agree with such a logical conclusion. Of course, this does not mean that one should unconcernedly watch a head pressing hour after hour through the pelvic outlet against an unyielding perineum since "this is inviting disaster" as Greenwood very appropriately states. In such a situation the proper treatment consists in episiotomy, and if then expulsion does not follow, in gentle extraction with the forceps.

It certainly is not reasonable to expect the obstetrician to make indiscriminate use of the forceps simply because a pathologist or neurologist arrives at the conclusion that such measure would save many babies. "After all," as Martin states, "the obstetrician always has and always will lay greater stress on preserving the life and health of the mother than that of the infant."

It can never be justifiable to apply forceps simply for the purpose of shortening labor for the comfort of the mother, and the mere changing of the fetal heart rate offers no indisputable indication for immediate interference.

Summarizing briefly all the new information gained in the past six years concerning intracranial birth injuries, we can state:

A fact, previously only suspected, now is definitely established, namely, that cerebral injuries of various character and different degree occur by far more often than was suggested by the discovery of lacerations of dural septa in approximately one-half of the infants either stillborn or dying within the first few days of life.

We understand more clearly than heretofore the possible or probable relation of such lesions to anomalies of physical and mental development of the child.

We should consider with greater concern every artificial method of hastening the expulsion of the fetus, especially if we know him to be premature.

We should remember the unquestionable fact that haste of any kind must imply a risk to the child far greater than the possible benefit expected from a quicker delivery.

Every newborn baby suspected of having sustained an intracranial trauma must be handled with extreme gentleness, particularly if premature. To swing the latter during resuscitation, in the belief of Ylppoe, to-day represents malpractice.

Injuries of Vertebral Column and Spinal Cord.—Primary breech labors and foot extractions subsequent to version prove not much less dangerous to the integrity of the vertebral column and spinal cord than we have shown these methods of delivery to be to the brain and especially to the septa of the dura mater. However, these vertebral injuries are discovered only if the autopsy includes a careful dissection of the column, which is yet to become the routine practice.

The high frequency of damage to the spinal column is clearly evidenced in the report of Pierson from the Sloane Hospital for Women. Analyzing the deliveries of the past three years only, he found in 142 viable primary breech labors an infant mortality of 12 per cent; in 87 viable version and breech deliveries, of 26 per cent. Of 36 cases carefully investigated at necropsy a spinal cord hemorrhage was noted in 47 per cent, fractured vertebræ found in 38 per cent. There was an intracranial hemorrhage present in 44 per cent, though it was extensive only in 25 per cent. He calculates that the probable cause of death in these 36 cases was: Trauma alone in 56 per cent; asphyxia alone probably in only 5 per cent; while both trauma and asphyxia might have accounted for death in the remaining 39 per cent.

Crothers also emphasizes the true but regrettable fact that injuries of the spinal cord are only rarely diagnosed by the obstetrician though decidedly often discovered by the pathologist and later in life, occasionally, by the orthopedic surgeon. Disability from such accidents, however, as a matter of fact, is not often seen in older children. Serious damage to the spinal cord then would seem not consistent with continued life. After an extensive experimental study of the problem Crothers, however, arrived at the conclusion that in breech labors another factor, outside the cord injury itself, must be the element which is really responsible for the infant's death, and suggests herniation of the cerebellum and medulla through the foramen magnum, as mentioned in preceding pages. Under normal conditions in breech labors the medulla is guarded from harmful pressure by the tentorium which modifies and controls the force imposed upon the vertex from above. Rupture of the tentorium and a combination of pressure and pull are likely to lead to this dangerous herniation of the medulla because of increased intracranial pressure concurrent with actual decrease of intraspinal pressure.

If a not immediately fatal injury involves the upper part of the cervical cord, the clinical symptom at birth will be apnea, since the phrenic nuclei will be involved. Injury to the cervical enlargement of the cord will cause palsy of the arm. Damage lower down will lead to a flaccid paralysis of some or all of the trunk muscles. Crothers and Putnam refer to the not generally

appreciated fact that in a surprising number of cases in which the most obvious disability consists in the paralysis of an arm, careful study will produce conclusive evidence that also the central nervous system is involved. Such birth lesions might affect: (1) Peripheral nerves, notably the brachial plexus; (2) the cervical sympathetic apparatus, and (3) the spinal cord.

Quoting again Crothers and Putnam: The chord is anchored firmly by the brachial plexus above and the cauda equina below, with but little support in the thoracic region. On the whole it is relatively inelastic and friable. The spinal column of the newborn, on the other hand, consists of a series of elastic rings joined by relatively brittle disks and ligaments. Obviously, excessive elongation of the spinal column may put intolerable strain on the cord or upon the meninges or both. Therefore, strenuous traction along the vertebral column in breech deliveries, Crothers agrees with me, is an extremely risky procedure —and proper warning against it should soon be given in all textbooks of obstetrics.

Of Wilson's 3 cases of fatal cord injury only in one could damage of the spinal column be ascertained.

More or less capillary hemorrhage, as Lovett emphasizes in the discussion of the paper of Roberts, must occur within the craniospinal canal of almost every newborn, and thus it cannot be surprising that blood is discovered so often in a very careful examination of the spinal fluid obtained in immediate puncture. For this same reason the presence of blood cannot necessarily prove the existence of an intracranial hemorrhage. Many of the paralyses seen in young children, Lovett concludes, are not due to hemorrhages in the brain but to injuries of the spinal cord.

A few individual observations will now be quoted since they illustrate clearly, in my opinion, certain important features of diagnosis and pathology.

Belfrage and Kohlbry among others describe the later consequences of such spinal birth injuries, the latter detailing a case which exhibits the almost typical sequence of subsequent pathologic manifestations leading to death: At birth a paralysis of the sphincter of the bladder; at the age of 3½ months, a marked pyuria; death at 9 months. Postmortem findings: Hydronephrosis, pyelonephritis, complete degeneration of all tracts in the cervical portion of the cord.

A disarticulation of the fourth and fifth dorsal vertebræ without any fracture, thus representing a distinctly rare occurrence, was discovered by Barney at the autopsy of a child, weighing 3500 Gm., delivered by means of version and extraction. A paper of Ford on the possible relation of breech delivery to spinal cord injury describes 6 more cases of this sort, 4 of them referring to babies delivered after podalic version. Five of the 6 he saw within two years, a fact strongly suggesting that these injuries are not so extremely rare. None of these cases showed evidence of any damage to the spinal column. In the 5 surviving infants the lesion had occurred high up in the thoracic segment, in the one fatal case the cervical enlargement of the cord was involved.

A case of anterior luxation of the fifth cervical vertebra, described by Harloff, is interesting in that the baby lived twenty-nine days with an injury

which as a rule proves immediately fatal. Version had been done on account of a shoulder presentation. The child was successfully resuscitated. On the fifth day postpartum appeared a spasticity of the hands and retention of urine with an ischuria paradoxa. An x-ray picture taken at this time suggested a luxation of a cervical vertebra. An attempt made to reduce the luxation seemed to result in some improvement but soon the paralytic symptoms became more marked and the child died on the twenty-ninth day. At autopsy the luxation was discovered.

Lindsay saw a child, 6 months old, with a flaccid paralysis of both legs, the ninth child of this mother. The injury had undoubtedly occurred at the level of the first lumbar vertebra but x-ray pictures failed to show any damage to a vertebra.

Engelman discusses paraparesis of the lower extremities in scoliotic nurslings, the column injury having been sustained in birth. In one instance the baby had been turned and extracted. The palsy of the right brachial plexus was immediately noticed but a paresis of the lower extremities undoubtedly overlooked at the time. At the age of 4 weeks the baby had a fixed kyphosis in the upper thoracic segment, a paraparesis of the lower extremities, etc. A definite diagnosis of compression of the spinal cord was made at the age of 10 months by means of myelography after injection of lipiodol. Very similar is another case mentioned by Engelman. Myelography done at the age of 6 months proved the kyphosis to be due to a luxation and fracture which was particularly marked in the tenth and eleventh thoracic vertebra impinging upon the cord. A column fracture so low down is extremely rare and was undoubtedly produced in the course of the breech extraction. Also in this case a right brachial palsy was immediately noticed. Myelography in these two instances completely cleared up both the character and the location of the birth injury. Obviously spinal cord degeneration had progressed too far to hold out any hope for a good result from a laminectomy. The thought, however, will naturally suggest itself that a myelography within the first few days of life might in the near future prove a valuable aid in preventing permanent damage at least in some cases of vertebral or cord injury by an immediate laminectomy.

Brachial Birth Palsy.—A thorough discussion of all the various aspects of obstetrical brachial paralysis will be found in a paper of Boorstein. From a study of 64 patients he concludes that the condition is due to stretching or tearing of the cervical roots of the brachial plexus. Almost always the condition is found associated with a history of difficult labor or artificial delivery. The right arm is affected more often than the left, and bilateral affections are very infrequent. The upper arm type, caused by injury of the suprascapular and fifth and sixth cervical nerves, is more common than the lower arm type. If these cases are treated early and properly one can expect good recovery of all mild cases in three or four months, but severe cases will require six to seven months. When no result is obtained by conservative measures within four months, nerve operations are indicated which later have to be followed with orthopedic treatment.

Froelich also feels that the prognosis in general is good and that the palsy only exceptionally leads to a permanent flail joint of the shoulder. Proper treatment, in his opinion, consists in immediate immobilization of the affected arm in a position in which all traction strain is taken from the roots of the plexus, and which at the same time is antagonistic to the contraction of the unaffected muscles.

Sever presents the analysis of an unusually large series. In 1100 cases of brachial palsy the lesion was found on the right side in 64 per cent. The most usual type is the so-called upper arm paralysis represented in 829 cases. In 63 instances both arms were found involved. Available obstetric information proves the etiologic importance of force combined with great muscular relaxation of the infant. Sever emphasizes the necessity of an early start with treatment, a point also stressed in a new paper by Boorstein.

Another case of that rather rare type of isolated paralysis of the radial nerve in the newborn is placed on record by Treu. The condition was noticed two days after an easy forceps extraction. An x-ray examination failed to reveal any bone injury. On the outer surface of the upper arm there could be seen a pressure mark on the skin, the size of a penny, which was infiltrated and situated approximately just above the musculospiral nerve, where it emerges between the brachioradialis and the brachialis anticus muscles. This part of the upper arm seemingly had been pressed against the promontory owing to a deflexed attitude of the head.

A child, weighing 4050 Gm., extracted with forceps, was observed by Petersen. It had an isolated palsy of the radial nerve without the slightest involvement of the triceps of the upper arm.

Bettmann saw a girl, 12 years old, whose lower arm was paralyzed with flexor contraction. Child was born after a prophylactic version for a contracted pelvis and paralysis immediately noticed. However, only x-ray study at the age of 12 revealed the actual cause of the palsy—a serious traumatic injury affecting more or less the four lower cervical vertebræ.

The brachial plexus, Harrenstein contends, is easily stretched and torn, particularly at Erb's point, but almost identical symptoms are caused by an injury to the epiphysis of the humerus. Early recognition of such a pseudoparalysis is essential for institution of proper treatment. With this same problem deals Pitzen who fully appreciates the great difficulties of a differential diagnosis. An epiphyseal detachment cannot be established positively in the newborn, if associated with a dislocation or a large tear in the periosteum, since crepitation, the only reliable diagnostic symptom, can never be made out. Epiphyseal detachment with dislocation, however, can be ascertained only if, at the site of the protruding diaphyseal end, the epiphysis can actually be palpated in the glenoidal cavity of the scapula, or if a definite difference in the length of both upper arms can be determined. Kuestner's dictum still remains correct: Epiphyseal detachment in the newborn is the injury which corresponds to luxation in the adult, in any joint. A true luxation of the shoulder in the newborn has been observed only once, a subcoracoid luxation

reported by Olshausen. To establish such a diagnosis it is necessary to prove that the glenoid cavity is empty.

Thus traumatic luxation of the shoulder probably never occurs in birth itself but may develop later when a complete shoulder palsy will result in extreme relaxation of the joint-capsule. There exists, however, a congenital luxation which brings the arm into the characteristic position of the Duchenne-Erb palsy.

In South American literature we find a paper by Rivarola which discusses in great detail the problem of differential diagnosis between brachial palsy, epiphyseal detachment, luxation and capsule tear.

The monograph of Crothers and Putnam contains the description of several most instructive observations. In Case 22, they found a brachial palsy associated with a fractured scapula subsequent to a difficult forceps extraction. Case 23 refers to a baby born after version and extraction done on account of eclampsia. The baby has a brachial palsy and fracture of the clavicle and of a few ribs. Case 25 is a double brachial palsy after a difficult breech extraction. Further investigation shows a probable injury of the upper thoracic cord followed by degeneration of cells in the anterior horns. Another instance of double brachial palsy is given as Case 26. Baby is born after difficult forceps extraction, but the real damage in this case probably had been done by swinging after Schultze. In this case the palsy seems more likely to be due to a cord injury with definite sympathetic nerve lesions (indicated by asymmetry of palpebral fissures).

A critical study of these and many similar cases can leave no doubt that often such palsies can be directly ascribed to excessive force applied either in the delivery or resuscitation of the child.

An adequate idea of the possible degree of, I might say, brutal force exerted in obstetric maneuvers one can easily gain by looking at the pictures of a 13-year-old girl, presented in a paper by Holzapfel. In a version and extraction the unfortunate child's left arm had actually been torn off completely at the shoulder. The wound had been sewed up and the infant survived this horrible mutilation.

Brachial paralysis in the majority of instances, according to Schubert, is due to a primary plexus injury although at times anomalies of the central nervous system contribute to its etiology. Observations of brachial palsy combined with other congenital deformities due to developmental defects speak in favor of such an assumption.

Phrenic Nerve Palsy.—The peculiar phenomenon of a partial paralysis of the diaphragm may well be taken up in this connection because evidence is accumulating rapidly to prove that this impairment of diaphragmatic respiratory function occurs, more often than heretofore suspected, in connection with a brachial palsy. Apparently a concomitant injury to the phrenic nerve is often overlooked. Friedman and Chamberlain, in a noteworthy contribution, justifiedly doubt that such a combination could be so very uncommon in view of the anatomic relation of the brachial plexus to the phrenic nerve. A baby seen by them had been extracted by means of a low forceps and had a right

plexus palsy. On the first day it had a few attacks of cyanosis which were not considered to be serious. Approximately on the thirteenth day the respiratory symptoms seemed to become severer. Three days later a diagnosis of pneumonia was made and therefore the infant examined with x-rays. This revealed the true condition, *viz.*, a paralysis of the right half of the diaphragm. The palsy of the arm disappeared within two weeks but at seven weeks the lung condition is found still unchanged. At the age of 8½ months the child seemed well and normal.

Very similar is an observation of Epstein who also is convinced that this occurrence must be more frequent than seems indicated by reports in literature. After a breech labor the baby exhibited the typical signs of a right-sided Duchenne-Erb palsy. At the age of 3½ months the respiratory anomaly of the diaphragm was discovered. Two years later the one half of the diaphragm can still be seen in its characteristic elevation. Landsberger, in reporting a case of right plexus palsy associated with a right phrenic nerve palsy, refers to various noteworthy facts. It seems that the anomaly of respiratory movements of the diaphragm often is first mistaken for some pulmonary disease. Radiographic study now greatly facilitates not only diagnosis but as well differential diagnosis from a congenital diaphragmatic hernia. Left-sided phrenic palsies seem to prevail in the reports, a fact explained by Weigert by the more protected location of the phrenic nerve on the right side. A case reported by Szanto presented a left-sided paresis of diaphragm associated with weakness of left facial nerve and a torticollis on the left, this particular combination speaking strongly in favor of a traumatic origin of the lesion.

Unique is the case reported by Dyson. Baby appears at vulva in a face presentation. Further progress seems prevented by a cord so tightly wound around the neck that it is necessary to cut it between two clamps. Accidentally the scissors cut through the skin about 1 inch above the right clavicle, approximately in the region of the scalenus muscle. The injury healed readily leaving a transverse scar. From the very beginning a rapid and noisy respiration was noticed, usually with a slight cyanosis on the slightest exertion. An x-ray plate made six weeks postpartum showed the diaphragm to stand extremely high on the right side. Further study revealed the paradox upward motion of the diaphragm on that side during inspiration while simultaneously the left half would properly move down. In this case, seemingly the only instance known in literature, the phrenic nerve had actually been severed with scissors during delivery. The child recovered completely within six months.

Torticollis.—Schubert suggests that the congenital wry-neck is caused by peripheral trophoneurotic disturbances due to cerebral defects. Weil objects to this view and advances evidence for his own contention that the shortening of the sternomastoid muscle is the outcome of abnormal pressure brought on by an anomalous intra-uterine posture. This explanation of the etiology of torticollis is most convincingly established in a case carefully studied and described by Stern.

Injuries of the Eye.—The ophthalmoscopic study by Jacobs of the eye-grounds of 157 infants within twenty-four hours after birth fully confirms

previous statements concerning the frequency of retinal hemorrhages. They were found by him in 12.1 per cent of all the newborn babies he examined. Extravasation of blood appeared either in the form of radial streaks about the disk or surrounding the latter in circular form. He contends that such traumatic retinal lesions might result in permanent changes.

In preceding pages I have referred to the investigations of Lachman concerning the frequency of intra-ocular hemorrhages in newborn infants and the occurrence of chorionic hemorrhages heretofore not even suspected. Lachman also discusses in this paper the possible serious after-effects of such hemorrhagic lesions. He found in literature 10 cases in which eyes had been enucleated for an assumed glioma while later histologic study proved that the ophthalmoscopic picture of a glioma was closely simulated only by a retinal detachment. In still another case, reported by Stoewer, one eye of a baby, 3 months old, had been removed under the diagnosis of unilateral glioma. Pathologic study of the specimen showed a detached retina, matted together, partially necrotic, and covering a large, fresh hematoma. A very similar situation confronted Lachman in the case he reports. In an infant, 3½ months old, three ophthalmologists entirely independent from each other made the definite diagnosis of bilateral glioma. Both eyes were removed. In each eye the retina was found detached, matted together into a funnel-shaped mass. Beneath each retina was a large amount of bloody serum, evidently the residue of an old hemorrhage. There was no evidence of a new growth. Thus there can be no doubt that an extensive intra-ocular hemorrhage in a newborn infant occasionally might lead to a condition which, as it appears, cannot be clinically differentiated from a glioma.

Doerfler noticed in an infant an exophthalmos within twenty-four hours after labor. On the seventh day the eye was bulging far out so that the lids could not close over it. A suspected orbital fracture was excluded by x-ray examination. Two days later there were observed clonic contractions of left arm and left leg, followed next day by contractions also of the right leg. Although a lumbar puncture yielded a perfectly clear fluid and the baby finally recovered, Doerfler feels certain that the exophthalmos in this instance was caused by an intracranial hemorrhage.

Of unusual interest is the practically unique observation recorded by Gerdes. Immediately after an easy low forceps extraction the left bulb was seen to lie outside the palpebral fissure. Slight pressure replaced it into the socket. In looking for the possible cause of this apparently serious injury, it was found that comparatively slight pressure against the frontal bone just above the supra-orbital arch immediately caused the luxation to recur. Again the eyeball was replaced with the greatest ease. The remarkable feature of this case is that Gerdes, eighteen years after this accident, had the opportunity to meet this infant as a full-grown, healthy girl. She had not the slightest visual disturbance. Frontal bone and orbital ridge were normal. In confessing to the parents that he had hidden from them the occurrence of this accident, which at the time almost had induced him to cut the eye off since it seemed to hang only on a few tissue shreds, he was told that this same acci-

dent had also occurred later when again the eyeball had been easily pushed back into the socket. In this case the luxation of the bulbus oculi unquestionably was the result of only normal pressure of a forceps blade against an unusually elastic frontal bone.

Another instance of luxation of the eyeball is placed on record by Wolff. In a septipara with a narrow pelvis a baby, weighing 3500 Gm., is extracted with forceps. The left bulbus is found to lie in front of the eyelids, hanging on the lateral rectus muscle and optic nerve, the latter torn halfway through its thickness. Ablation of eye was inevitable. There were distinct forceps marks visible on both frontal bones, so that the luxation evidently had been caused by direct pressure.

Thomson and Buchanan, in 1903, had carefully described a traumatic keratitis seen in the newborn (see my monograph, page 138). Some interesting observations have been recently reported which clearly prove the causative connection of this keratitis to traumatization of the cornea in birth.

Byers contributes 3 cases. Case 1: Slightly asphyxiated child, extracted with forceps, is readily resuscitated. There is a partial paresis of left facial nerve. Within forty-eight hours a vertical band of interstitial infiltration or edema of cornea is noticed in left eye. Corneal epithelium is intact. The central haziness slowly spreads over entire cornea and then gradually subsides. When seen six years later the child has a convergent strabism. In left cornea is seen a faint linear scar about 2 Mm. wide. Case 2 refers to a deeply asphyxiated child extracted with forceps. Next day a haziness is noticed in left eye without loss of surface epithelium. There is a small hematoma in the anterior chamber. Two weeks later, with the slit lamp, a rupture of Descemet's membrane can be made out, still visible three months later. The borders of the scar are glistening. Also the third case concerns a forceps extraction. Six years later a faint corneal opacity is seen, due to a rupture of the membrane of Descemet.

Bos believes with Peters that the streaks, visible only by illumination with the slit lamp and then resembling fine glass splinters, undeniably indicate a tear of this membrane. Bos's patient was 10 years old when brought to him for defective vision. Glass splinter formation was distinct and most probably the end result of the high forceps made at birth.

Injuries of the Ear.—Reference already has been made to hemorrhages in the vestibulary apparatus described by Voss, Berberich, Wiechers, etc. Hartog believes that so-called congenital deaf-mutism more often than is usually suspected is due to actual injury of the hearing mechanism in labor. In other cases the damage may consist merely in hemorrhage into the labyrinth or cochlea, caused by undue pressure over the temporal bone, especially from awkward application of the forceps.

Quite recently Voss has summarized all the known or only suspected relations of birth trauma to the auditory apparatus. Outside of the distinctly peripheral injuries in the os petrosum, which as shown by him and some of his coworkers might interfere with, or actually obviate, proper function of the cochlear and vestibular apparatus, the histologic investigations of Philip

Schwartz and others strongly suggest that difficulty of hearing, deafness or deaf-mutism in some cases might stand in relation to circumscribed degenerated areas within the brain as the result of damage sustained in labor.

Injuries of the Scalp.—Fueth demonstrates in detail how a ringlike pressure necrosis of the soft tissues on the child's head can result from the spasmodic contraction of the cervix about it. Indeed, in his own case and in another quoted from literature this same condition appeared in two successive labors, with no pelvic contraction nor any other possible cause for the injury. Analyzing several other cases of this sort, as reported in literature, he notes that in all of them labors were prolonged and the membranes had ruptured prematurely. In several of these instances it could be shown that it was a spasm of the internal rather than of the external os which occasioned the injury and in his opinion this explanation holds true for all cases. Several of the infants died as the result of an infection of the necrotic area.

Fueth's contention appears strongly supported by newer contributions. In a case of Heidler's an abnormal rigidity of the cervix probably resulted from a preceding cervical amputation. Mayer discusses this problem in connection with the report of such a scalp injury seen in a little patient born by a multiparous woman. After disappearance of the caput succedaneum there remained a deep furrow surrounding a necrotic skin surface covered with a crust. He quotes several other cases of this sort recorded in literature. In a case of Fueth the child retained permanently an entirely bald spot on its head. A critical consideration of the etiology and sequelæ of this occurrence together with an extensive bibliographic list will be found in a paper by Poeck.

Such traumatic lesions must be clearly differentiated from congenital skin defects at least for the one reason, pointed out by Moeller, that the patients seem prone to interpret the congenital lesions as injuries produced by the attending physician or midwife. In some instances, he emphasizes, a clear distinction between these two types might be impossible. Neumann, dwelling on this same point, stresses the necessity of differentiating either type from luetic ulcers. In his opinion, at least in the two cases described by him, the defects were congenital, the result of amniotic adhesions. Walz doubts that this commonly assumed etiology holds true for the majority of congenital defects. He believes that they, like harelip or syndactylism, etc., more likely have an endogenous origin, and exhibit the following etiologic progressive stages: Acrania, hemicrania, encephalocele and, least marked, merely a skin defect. That they occasionally are found associated with anomalies of the bony skull roof is pointed out by Neumann in another paper.

Burger fully agrees with Walz's theory of their origin, reporting an unusually large skin defect in a second-born child. The mother asserts that also her firstborn had this same anomaly.

During 1927 this problem again has been exhaustively discussed in two papers. Lundwall concludes that in the origin of congenital defects of the skin of the skull, hereditary predisposition is of minor importance. In the main they seem to be caused by limited space within the uterine cavity, as a rule, associated with oligohydramnios. Heinrichsbauer points to the fact that

congenital skin defects most commonly are located on the skull. He realizes that direct pressure, amniotic bands, developmental anomalies and even syphilis might be of etiologic significance, but none of these explanations would seem to apply clearly to the case he reports.

Bone defects, like the skin defects, not only are unjustly interpreted as traumatic injuries and blamed on the attending physician, but might prove mystifying during labor in diagnosing accurately the presentation. They occur most often in parietal bones (Abel).

Heidler discusses this entire problem in detail. In his own case, the full-term, though somewhat small, child had a sharply defined skin defect over one parietal bone. Underneath this skin defect also the bone was missing, and more anteriorly the parietal bone was soft and of a spongy consistence. When the infant was 4 weeks old a severe hemorrhage occurred from this area which finally was controlled by tight compression with bandages. Later, bleeding reappeared whenever the child was crying. At the age of 2 months a meningitis was soon followed by death. A partial autopsy showed that the bleeding originated from the longitudinal sinus. The author compares the various striking similarities between this case and one recorded previously by Moeller, and discussing the etiology of such defects he expresses the belief that it is unlikely they are caused by amniotic adhesions but more probably represent primary inhibitions of development of a still unknown etiology.

Other Skin Damage.—Fink describes peculiar skin lesions of a newborn infant along both forearms looking like healing wounds. He acknowledges that this condition might be of trophoneurotic origin but a careful analysis of the actual position of the baby in birth, etc., suggests to him that these have been actual wounds caused by a heavy fall of the pregnant woman against the sharp edges of the bed. The accident had occurred about two and a half weeks before delivery.

Excessive intra-uterine pressure in a case of oligohydramnios seems to have played an important rôle in the case reported by Liegner. At birth the baby showed fresh-looking wounds above the wrists on both arms. I myself have observed an almost identical condition. In my case areas of superficially necrotic skin could be seen immediately after birth on both heels and over both tibiæ. Placing both legs into a crossed position, a typical attitude, it could be demonstrated that these four lesions really represented a practically continuous surface, and likely were due to excessive pressure of the contracting uterine wall. In this instance the wounds healed slowly leaving thin scars still visible after several years.

Heidler, in 1925, dealt with a phenomenon known to all obstetricians. In more than one-third of all forceps babies, dense, circumscribed infiltrations, round or oblong, resembling swollen glands, will be noticed within a few days postpartum on one and less often on both sides of the face. Often up to two months are required for their complete disappearance. These infiltrations have been rather generally accepted as almost typical forceps lesions. Marfan is convinced of their traumatic origin since they are found only in connection with difficult labors. In a case of Carol and van der Zande such infiltrated

skin areas actually became necrotic. Since the child had been born deeply asphyxiated they ascribed the lesions to unusually brusque manipulation during resuscitation.

The term "subcutaneous fat necrosis" suggested for this condition by Bernheim-Karrer (*Schweiz. med. Wchnschr.*, 1922) is thoroughly disapproved by Sysak and Wilfand. Keilmann in Germany and several French writers (Debrey, Hallez, etc.) thought that this lesion is primarily caused by a hypercholesterinemia, though it might be more immediately brought on by a trauma. In a careful study of such a case Sysak and Wilfand ascertained a slight general hypercholesterinemia but found locally an accumulation of pseudoxanthoma cells, rich in lipoids. Here and there fatty cells would show a beginning necrosis with the formation of masses of calcium soaps. Undoubtedly at times such cases are erroneously diagnosed as scleroderma. They consider the term fat necrosis as certainly wrong and propose in its stead "pseudoxanthomatosis of the newborn."

Fractures and Luxations.—A few newer observations of intra-uterine fractures of long bones of the fetus, seemingly caused by an external trauma, are worthy of citation.

In the case of Genova a fracture in the lower third of the left leg was at the time of birth in the state of advanced healing with a marked angle at the site of the break. In his opinion the fracture was produced by an accident sustained in the seventh month of pregnancy, but its occurrence favored by a coincident oligohydramnios, since the latter condition exposes the fetus more directly to traumatization by an external force.

Most remarkable is a case reported by Rouvier to the Obstetric Society of Paris. Though evidently full term, the infant weighed only 1710 Gm. It showed multiple fractures of the extremities resulting in angular bending, especially of both limbs. He accepts as a perfectly plausible explanation of this striking deformity the fact that the patient, with the definite intention to produce an abortion, had worn from the seventh month of pregnancy a band around the abdomen, tight enough to cause partial necrosis of the skin underneath it. The continued constriction, in his belief, accounts for the small size of the infant and must have caused the fractures because the band came to lie just over the lower extremities with the fetus in a vertex presentation.

Decidedly less convincing as an example of fetal traumatization by external force proves a case described by Fink. A woman, about seven to eight months pregnant, fell from a bicycle. She gave birth, forty-eight hours later, to a premature child, born in a breech presentation, which soon died. Fink insists that the fetal subdural hematoma, discovered at autopsy, must have been caused by the accident in spite of the fact that the skull bones were found intact.

The entire question of fractures occurring during birth is thoroughly discussed in a thesis by Stinz.

While, in general, injuries of the upper extremities during the management of the after-coming head are fairly common, among them only rarely is found a luxation of the elbow, *e.g.*, in the case of Kahn. The existence of the injury in this premature infant was discovered only on the fifth day on account of a

swelling. Reposition became impossible because the median epicondylus of the humerus had been detached.

Incident to the discussion of brachial plexus injury in preceding pages reference already has been made to newer papers dealing with the traumatization of the shoulder in birth.

An unusual combination of congenital defects and birth fractures is exhibited in the case reported by Murken. A full-term child, weighing 3750 Gm. is spontaneously born in a head presentation by a multiparous woman. On examinations it shows: Large wide fontanels, a luxation of the right end of the maxilla, an apparent limitation of mobility in both hip-joints and bilateral, symmetrical, fresh fractures (no signs of callus visible in x-ray plates) of both femurs, and finally a spina bifida, size of hen's egg.

A detailed discussion of the problem of femur fracture will be found in my monograph (page 205). A new case by Hoelder, explained by pressure of the posterior pelvic wall against the knee, and a case of Fressel, in which the femoral fracture apparently was caused by a partial fixation of the thigh in flexion, illustrate well commonly accepted views concerning the origin of such fractures. Contracture of both hip-joints represents the most likely cause of the fracture of both femurs mentioned above in Murken's case.

Brandt reports a new case of congenital contracture of the knee. One can readily understand how, for example, in a breech labor unavoidable traction on the leg under such conditions necessarily would result in a fracture.

The origin of luxation of the knee-joint, Sachs points out, has never been satisfactorily determined. The theory of abnormal intra-uterine direct pressure on account of scantiness of amniotic fluid certainly could not apply to his own case. Sometimes the condition is due to an abnormal relaxation of the joint-capsule and this factor might account for the occasional observation of such a luxation in several children of the same mother, or in several joints of the same child. Potel thought of a primary retraction of the quadriceps. Drehman assumed that during intra-uterine growth the affected leg had been maintained in an abnormal posture by the foot being caught under the chin or in the axilla of the fetus. Sachs concludes his paper with the assurance of a fairly good prognosis if treatment is started early.

A very thorough study of the problem of pseudoluxation of the knee and backward luxation of the foot in the talocrural joint as the result of a birth trauma has been recently presented by Szenes. A congenital luxation differs from the traumatic type in that the former fails to show any injuries of the greatly relaxed ligaments and joint-capsule. The most common form of congenital luxation is represented in the genu recurvatum in which flexion of the knee is impossible. Congenital lateral luxations are extremely rare and in the opinion of Szenes probably do not actually exist. When found they are more likely of traumatic origin, occurring during labor (Gillicudy, Offergeld), favored by a congenital laxity of the capsule (Wehsung), or are actually produced by unusually awkward and forceful manipulations of the leg during delivery.

Wehsung has emphasized the noteworthy fact that in more than half of

the cases of congenital anterior dislocation of the knee the anomaly appears on both sides and often is associated with dislocations as well of the hip-joints, with anomalous position of the feet, and usually the patella in these cases is very small. Magnus has even described a familial type (in three infants of healthy parents).

There also occurs a traumatic separation of the epiphyses in the knee-joint (Kuestner, *Volkmann's Samml. klin. Vortr.*, 1879). Described by some authors as common, completely denied by others, this injury is qualified as rare by modern orthopedic surgeons (Spitzy). More frequent is a detachment of the lower femoral epiphysis (Poland and Kirmisson).

Szenes' case was first diagnosed as relaxation of the medial lateral ligament of the left knee, but more careful study finally proved it to be a separation of the lower femoral epiphysis with loosening of the proximal tibial epiphysis. This lesion was discovered in a full-term child extracted after a prophylactic version for slight pelvic contraction. The mechanism of such an injury is described in detail in this paper.

Congenital backward luxations of the talocrural joint (carefully analyzed by Berard and Freiberg) in the opinion of Borchardt are certainly not of traumatic origin but represent true deformities.

Detachments of the epiphyses at the distal ends of tibia and fibula occur in young individuals. No case of this sort has heretofore been recorded in a newborn infant. In the case of Szenes a foot had been pulled down on account of a prolapsed cord. Soon after birth a hematoma developed over the external malleolus. X-rays showed a posterior dislocation of the talocrural joint but no fracture. On further study it became evident that the epiphyses of both the tibia and the fibula had been torn off in the obstetric procedure.

Hemorrhages in the Suprarenal Glands.—It affords great satisfaction to realize that newer knowledge concerning birth injuries tends to reduce visibly the number of instances in which even autopsy fails to reveal the cause of death in stillborn or very young infants. An improved technic in the examination of the head, a careful dissection of the spinal column, especially of its cervical portion, a study of the spinal cord or of the pons, etc., as shown in preceding pages, furnishes a great deal of unexpected information. The proper routine autopsy on a newborn infant should include as well the inspection and study of the adrenals. In this connection I wish once more to refer to the report of Wilson on necropsies performed on newborn babies. It contains 3 instances of fatal adrenal hemorrhages.

The adrenals are not infrequently injured in labor and particularly by manipulations in which the baby is grasped around the waistline.

Vallois and Roume saw a full-term baby, without any difficulty borne by a quartipara, collapse on the second day and die on the third day postpartum. The only pathologic finding discovered at necropsy to explain the death consisted in hemorrhages in the adrenals. In a case of Cornil and Tonzard a spontaneously born child, asphyxiated but successfully resuscitated, died eight hours later. Both adrenals were found completely torn apart by large hematomata so that only a narrow edge of suprarenal tissue was remaining. There

were no other noteworthy autopsy findings. The fatal injury must have been produced during the manipulations in resuscitation.

The report of Browne, comprising a series of 400 cases of stillbirths and neonatal deaths, contains 27 instances of suprarenal hemorrhages, only 6 of these children being born alive but dying soon, the latest four days postpartum. Usually the capsule of one or both glands is found distended by the hematomata in the medulla, and only occasionally the extravasated blood had burst into the free abdominal cavity. Browne points to the noteworthy fact that this accident seemingly is about 22 times as likely to happen with breech as with vertex deliveries, 3 times as likely in premature as in full-term infants.

Newer observations are recorded by Commandeur, Joseph and Rabau and the injury more in general is discussed by Roesner when speaking of damage to parenchymatous organs incident to breech labors.

To Corcoran and Strauss seemingly belongs credit for the first successful operation on a suprarenal hemorrhage of a newborn infant. This baby, weighing 5575 Gm., was borne by a quartipara. It became sick on the fourth day. An abdominal mass over to the left side was discovered the next day and the baby operated upon the same afternoon. A hematoma, the size of a fetal head, was removed from the intact adrenal capsule and but one bleeding point ligated. The infant recovered and remained well—a remarkable proof of good surgical judgment, an encouraging example of the efficacy of prompt and proper interference for a most serious type of birth injury.

Liver Injuries.—Reports of fatal injury to the liver in birth appear with increasing frequency. The cases of Wilson or Green merely reflect typical clinical occurrences—a breech extraction, sudden exitus a few days later and at postmortem the usually quite unsuspected discovery that the liver is injured. But such damage undeniably may occur also in entirely spontaneous labors. In the case of Berry a large full-term child is born spontaneously after a normal and easy labor. Quite unexpectedly it died suddenly on the fifth day. At autopsy a large hematoma is found in the right lobe of the liver, blood oozing from a small tear in the capsule. There was no resuscitation required in this infant, the injury undeniably was sustained in labor. Raisz saw a spontaneously born, not asphyxiated child of a sextipara develop the symptoms of an intestinal obstruction. A laparotomy made on the fourth day postpartum revealed a long laceration in lower edge of the liver.

Particularly instructive seems a case reported by Lackschewitz. After an entirely spontaneous labor a seemingly normal baby is born. Icterus developed on the fourth day and persisted. At the age of 7 weeks this infant had acholic stools and the diagnosis of aplasia of gall-ducts was made. Baby died a week later and autopsy showed an extremely large hematoma of the liver, undeniably the result of severe traumatization in the course of a spontaneous labor. The liver of the newborn is very large and it is obvious that any sort of abdominal constriction will press this succulent organ against the unyielding spinal column and thus might cause the capsule to rupture.

Other Injuries.—Justly and unjustly, as pointed out by me at various occasions in the foregoing pages, vigorous or unskillful manipulations of the

asphyxiated child and in particular Schultze's swinging have been credited as important and common causes of traumatization of the newborn infant. They indubitably are fraught with dangers and actually prove disastrous in some cases. Gentle procedures certainly are not less effective and more recently Israel recommends as a useful and positively harmless measure in resuscitation the use of the faradic current.

Experiments made by Hoerder, in 1909, had shown that a pressure of 40 cm. water (corresponding to 0.04 atmosphere) is sufficient to rupture alveoli in the newborn. This in itself proves the inherent dangers of all mechanical insufflation of oxygen or air into the lungs of the asphyxiated child. Two recent observations force Poeck to the conclusion that even the customary arm movements of artificial respiration and all stretching and bending of the thorax are capable of rupturing the lungs and resulting in edema of pleura and pericardium. A baby seen by Knoflach showed edema of the skin around the neck and died on the fifth day. Autopsy revealed edema of the mediastinum, originating from an injury of the mucosa of the larynx. In this case the injury evidently was produced by a rigid aspirator employed to remove mucus. In this particular instance a large thymus might have compressed the larynx and thus favored the production of the injury. Fischer, in the discussion of this paper, mentions several other cases of emphysema of the skin of the neck reported in literature, none of them apparently coincident with larynx trauma. However, there are several observations recorded of larynx injuries as the result of employing the highly objectionable rigid aspirator. Kaiser and Schrader deal with the problem of mediastinal emphysema and air embolism in the newborn. In their case no resuscitation was required. Tears in the lung tissue, discovered at autopsy, must have been produced in the course of labor. The baby was small (2500 Gm.) and easily borne by the triparous mother in a short labor. During labor the fetal heart rate had dropped to 56 and meconium passed. A cerebral injury was suspected but no dura lacerations could be found, small hemorrhagic spots, however, could be seen in various parts of the brain.

Wilson saw at autopsy rupture of peripheral alveoli in three infants, all three having been subjected to some method of resuscitation. Ross discovered at postmortem of a baby, dying on the fourth day after a spontaneous delivery, a large bilateral hematothorax, in his opinion, the result of hemorrhagic disease of the infant.

Serious testicle hemorrhages have been reported from time to time. Haselhorst quotes several such observations from literature and adds one more case. On account of signs of beginning asphyxiation, in a breech labor, a large baby (4300 Gm.) was quickly extracted. Resuscitation proved ineffective. A complete infarction of both testicles, epididymes and spermatic cords is found, in his belief, the combined result of passive congestion from asphyxiation and the suction effect of the lower outer atmospheric pressure. Smaller hemorrhages in the testicles probably are not uncommon in breech labors and he refers to their possible connection with atrophic condition and induration of testicles, without any known cause, occasionally seen in adults.

This résumé of literature published up to the end of 1927 might appropriately be closed with a reference to a paper of Berberich which clearly evidences the present endeavor to discover still unknown injuries, almost physiologically inflicted on the infant in birth, and their possible sequelæ, noticeable only later in life.

Staemmler and Wegelin (*Virchow's Arch. f. path. Anat.*, 1915, 219) ascertained that a struma parenchymatosa teleangiectatica in the newborn is the result of a blood stasis produced during labor. The condition disappears within the next three or four weeks. It occurred to Berberich, that the pituitary then could be expected to show a still more marked effect of labor since its venous system is so closely connected with those larger venous sinuses which, as we now well know, are so markedly exposed to various mechanical effects of labor. Therefore, he set out to study in complete serial sections the pituitary glands of 40 stillborn or early dying babies. In 32 of them he found a definite hyperemia with an almost characteristic distribution, the distention of capillaries always being most marked at the border between anterior and posterior lobe. At times small extravasates of blood could be seen, only rarely an actual necrosis. In none of these instances of necrosis a lues of the mother could be established, they certainly did not represent gummata. Necrotic areas in the hypophysis have been described by Simmonds, in 1914, and he considered them as characteristic for congenital lues. Similar observations had been recorded by Jaffé (*Frankfurt. Ztschr. f. Path.*, 1922, 27). Nonne (*Deutsch. Ztschr. f. Nervenh.*, 1922) reported 4 cases of adiposogenital dystrophy and 2 cases of infantilism ascribed by him to the effect of congenital lues on the hypophysis.

Berberich contends that it is impossible to say what the later effect of such hemorrhagic lesions of the glands sustained in the course of labor might be, but literature undeniably contains cases of far-reaching anomalies subsequent to non-syphilitic necrotic processes in the pituitary. Many very interesting cases are cited by him, proving the possible connection of idiocy, dwarfism, Fröhlich disease, genital hypoplasia, etc., with hypophyseal atrophies and necrosis of unknown origin.

The hyperemia of the pituitary in the newborn is always due to a thrombosis of veins, especially in the sinus cavernosus or adjoining sinuses. Thus as the result of physiologic natal trauma, a hyperemia, atrophy or even necrosis might occur and particularly in the anterior lobe. Clinical observations suggest strongly that they probably play a rôle in certain general diseases of childhood, such as cachexia, idiocy, dwarfism, myxedema, adipositas and even diabetes mellitus.

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EXTRA-UTERINE PREGNANCY

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During the past four years there has accumulated a fairly large literature concerning ectopic pregnancy, but no very radical views as to its pathology, symptomatology, or treatment have gained acceptance. The most important progress has resulted from the widespread attempt to improve the treatment of abdominal pregnancy, with special reference to the management of the ectopic placenta. This work will be discussed in detail below. Some new diagnostic symptoms and signs have been elicited, the pathology of the condition has undergone careful scrutiny but in general the principles laid down in the body of this book remain unchanged.

A brief review of the more important contributions since 1921 follows.

Etiology of Extra-Uterine Pregnancy.—The generally accepted cause of tubal pregnancy, obstruction of the tubal canal from within its lumen, carries with it the query as to whether such obstruction is more generally postinflammatory in origin or whether there are present congenital malformation of the tubes. Schoenholz (*Arch. f. Gynæk.*, 1923, 120: 44) made anatomic examination of 32 pregnant tubes and in 26 cases he found a mesh or diverticulum formation which he considers as paramount in etiology. This observer holds that the mesh formation is not comparable to the changes in the tubal mucosa brought about by inflammatory change and considers the process a congenital anomaly.

Studies of large numbers of tubes at the seat of gestation, conclusively prove, however, that no one cause may be assigned for the production of these lesions. Peritoneal adhesions causing stenosis by occlusion from without, the tubal mucosa presenting no abnormalities whatever, with an ovum implanted distal to the obstruction, form too common a clinical picture to be ignored. So, also, the observation of plastic exudate gluing together folds of the mucosa, together with the evidences of a healing salpingitis are very usual findings, while congenital anomalies and diverticula are somewhat uncommon.

Cause of Uterine Bleeding in Ectopic Pregnancy.—Polak and Welton (*Am. J. Obst. & Gynec.*, 1922, 3: 164) have shown that uterine bleeding does not occur while a tubal ovum is healthy and development is proceeding. When there is ovular unrest, however, some damage being done to the tubal embryo by interovular hemorrhage and hemorrhage into its sac, there is bleeding from

the uterine decidua (which is always found in greater or less degree in cases of tubal pregnancy), as well as from the decidual areas in the tube.

While tubal pregnancy is being terminated the tube undergoes some wave-like intermittent contractions, which are transmitted to the uterus when this organ in turn contracts as in abortion, giving rise to bleeding and separation of its decidua. In addition, should the tubal gestation be situated near the uterine end of the tube, there is usually some blood forced into the uterine cavity from the tube itself.

The uterine bleeding, which is usually small in amount, may continue for a considerable time after the attack of abdominal pain which apparently marks the destruction of the embryo. This is due to the fact that the termination of the tubal pregnancy is not necessarily at once complete, chorionic villi remaining alive, exerting their stimulus upon the uterus (Polak and Welton).

Termination of Tubal Pregnancy.—Recent literature contains several important contributions to this subject, the trend of thought being rather to discredit the long-held view that tubal abortion is one of the two usual end results of tubal implantation of the ovum. Litzenberg (*Tr. Am. Gynec. Soc.*, 1920, 239), describes the microscopic anatomy in a series of cases where the pregnant tube was cut parallel to its long axis, serial section of the whole tube being so studied. He maintains that the condition called tubal abortion is not, strictly speaking, an abortion, analogous to a uterine abortion, *i.e.*, a separation of the ovum from its attachment and extrusion by the activity of the musculature of the tubes. If the implantation is near the ostium abdominale it may grow out from the fimbriated extremity by simply increasing in size, protruding from the end of the tube but not detached from its imbedding in the tubal wall.

If the implantation is near the uterine end of the tube the termination may be by internal rupture through the inner ovum capsule into the tube lumen, or, rarely, separation of the ovum, in which case it perishes, may become a tubal mole, or it may be pushed along toward the fimbriated end by the hemorrhage, but not by the tube muscle.

McDonald has advanced the theory that tubal pregnancy really takes place outside the tubal mucosal canal and between the muscular coats of the tube wall. With the growth of the ovum there is dissection of the muscular coats of the tube and destruction of the tissue by the invading trophoblast.

The first common accident is intramural extravasation of blood which precedes the first symptom of tubal pregnancy. Fimbrial rupture follows in two-thirds of the cases. Fimbrial rupture often occurs through dissection of the muscular coats to their juncture with the mucosa at the fimbria and hemorrhagic discharge at the end of the tube through a break in the tissue (Ellice McDonald, *Am. J. Obst. & Gynec.*, 1923, 6:73).

These opinions are not valid, in the judgment of the writer, since the mechanisms described by Litzenberg in the development of what he terms internal rupture is precisely that of incomplete uterine abortion; death and extrusion of the embryo with hemorrhage and the continued attachment of the sac of the ovum to the uterine wall, until its separation is accomplished

by a sort of sloughing or, indeed, by manual measures. So far as McDonald's fimbrial rupture is concerned, this accident probably does occur, but it certainly does not constitute a usual termination, since the protrusion of the ovum directly through the fimbriated extremity of the tubes has been demonstrated in so large a series of cases.

A most remarkable termination is that reported by Streeter (*J. Am. M. Ass.*, 1923, 80: 989):

The author believes this is the first reported case in which a human ovum became implanted and underwent development entirely outside the abdominal cavity. A woman, aged 25, had been married four years. She had had one abortion but no children. When first seen she exhibited a mass the size of a cherry in the lower abdominal region at the upper end of a scar from a previous operation. A provisional diagnosis of wound-hernia was made. When seen two weeks later the swelling had doubled in size, and on account of its rapid growth an exploratory examination was decided on, the swelling at this time having reached the size of a hen's egg. Operation disclosed, just beneath the skin, embedded in the superficial fascia, a relatively thin-walled and partially transparent cyst, which on removal proved to be an intact chorionic sac, and on being opened was found to contain a well formed embryo. The operative area was carefully examined, but no opening through the deep fascia or connection with the abdomen could be found. Nor was there any enveloping capsule or any structure other than is normally present in the abdominal fascia, although there seemed to be some enlargement of the blood-vessels leading to the area of implantation. It appeared that two years before the patient had had a ventral fixation of the uterus and the surgeon had adopted that procedure in which the round ligaments are pulled through the rectus muscles. It is possible that he mistook the fallopian tube for the round ligament or drew the tube through the rectus muscle along with the round ligament. It is assumed that the fertilized ovum in this case was arrested at the tubal kink and, eroding through the mucosa of the tube wall, continued its development in the loose tissues superficial to the rectus muscle.

A detailed study of the specimen showed that the chorion and its contained embryo appeared to have grown about as well as they would have had the implantation occurred in the uterine mucosa. In general form and microscopic structure they could not be distinguished from normally implanted ova of the same stage of development. The tissues of the embryo showed beginning degenerative changes indicating that it had reached its maximum development and that the heart had stopped before the time of operation. The relative development of the hands, feet, ears, eyes, and mouth region was normal for the length of the embryo, and corresponded to about the end of the eighth week. The external genitalia were developed in proportion to the other parts of the body and were female in type. Whereas the embryo showed a development of eight weeks, the clinical record obtained from the patient gave a menstrual age of ten weeks, the discrepancy being accounted for by the retardation and arrest in development.

Multiple Tubal Pregnancy.—*Tubal Twinning.*—It has been shown that the relative frequency of single ovum twins as compared to the double ovum

variety is far greater in tubal than in uterine pregnancy and a valid and lucid explanation of this phenomenon is suggested by Arey (*Am. J. Obst. & Gynec.*, 1923, 5: 163), who is hereafter quoted *in extenso*.

It seems to be definitely proved (by the experiments of Stockard and others) that the primary cause of an abnormal development including twins is a developmental inhibition or arrest; the exact type of deformity that results depends solely on the precise moment when the interruption occurs. The direct application to twinning is as follows: The periphery of the blastoderm possesses many points where an embryonic axis might arise. In ordinary single development one such growing point, apparently by virtue of its favorable positional advantage, gives the supremacy and suppresses all other potential points, just as the terminal bud does the lateral ones in some plants.

If, however, the developmental rate is slowed at the critical moment when this axis is about to assert its dominance, its advantage is then lost and one or more neighboring points can now compete on more equal terms and may assert themselves as additional embryonic axes. If these growing points are far apart, separate individuals result; if nearer together, various degrees of conjoining. The critical moment for twinning is at the onset of gastrulation, which in mammals corresponds to the formation of a primitive streak. Thus the production of twins (separate or conjoined) and all non-hereditary malformations of organs and parts, are reducible to a single causative factor, namely, a properly timed developmental onset.

The application of the principle to the ovum in extra-uterine pregnancy lies in the fact that the ovum is subject to delay before implantation due to the impediments to its passage through the tube until it reaches such size that it can no longer reach the uterine cavity, or the ovum may be incarcerated in diverticula or blind passages where it must perforce remain.

The implantation of the ovum has therefore been greatly delayed, and furthermore its imbedding in the tubal mucosa is always associated with a deficiency or oxygenation of the growing embryo and a consequent developmental arrest at the critical moment for twinning. Two embryonic axes are apt to result with the production of monochorial twins. Checks, permanent or temporary, while the chorion is struggling to overcome natural deficiencies in its nidus, are sufficient to account for excessive twinning and the frequency of double malformations in extra-uterine fetus.

In another valuable contribution Arey (*Surg., Gynec. & Obst.*, 1923, 36: 407), collected the reported cases of tubal twins and those of plural pregnancies, where one fetus occupied the tube, the other being implanted in its normal nidus, the uterine cavity.

Arey presents 40 authentic cases, which withstand critical analysis, 8 presumptive ones, and 4 which are possible but doubtful.

Superfetation and Superfecundation in Tubal Pregnancy.—Discussion of multiple tubal pregnancy leads naturally to a consideration of the vexed question of superfetation in these cases. The generally accepted definition of superfecundation as well stated by Radasch (*Surg., Gynec. & Obst.*, 1921, 32: 339), is that condition in which two or more ova belonging to or origi-

FIG. 1.—PHOTOGRAPH OF 12.3 MM. HUMAN TUBAL TWIN EMBRYOS ATTACHED TO A COMMON YOLK SAC. × 2.3.

FIGS. 2 AND 3.—ADDITIONAL PHOTOGRAPHS OF THE COMMON YOLK SAC SHOWN IN FIG. 1.

The origin of the separate yolk stalks is apparent. × 2.3.

FIG. 4.—PHOTOGRAPH OF A PREGNANT HUMAN UTERINE TUBE.

Part of the wall has been removed to show the twin embryos in place. The simple yolk sac belongs to the 11.5 Mm. embryo at the left. The 12.0 Mm. embryo at the right lacks both yolk sac and stalk. × 1.7.

FIG. 5.—PHOTOMICROGRAPH OF A SECTION THROUGH THE UMBILICAL CORD OF THE EMBRYO AT THE LEFT IN FIG. 4.

The yolk stalk lies in a cœlomic extension. The level is too far distad to include the allantois. × 24.

FIG. 6.—PHOTOMICROGRAPH OF A SECTION THROUGH THE UMBILICAL CORD OF THE EMBRYO AT THE RIGHT IN FIG. 4.

There is no trace of a yolk stalk. The delicate tube below is the allantois. × 24.

From Arey, *Surg., Gynec. & Obst.*, March, 1923.

For Legends, See Opposite Page

nating at the same ovulation period are fertilized from sperm from coitus practiced at different times by the same or another male. The ova may originate from one or both ovaries, but in the latter case the ovulation must be practically simultaneous.

Superfetation is the fertilization of two or more ova that belong to or originate at different ovular periods by sperm from coitus at the same or different times by the same or another male. This assumes a pregnancy superimposed upon another by the fertilization of an ovum of a later date.

The essential difference between the two terms lies in the fact that in the former instance the ova are separately fertilized but themselves are of the same maturity, that is, they are products of the same ovulation period, while in the latter, the ova are of different ages, products of two ovulation periods. The possibility of the occurrence of these phenomena is still in doubt, the Germans usually denying its existence while the French and American observers credit it.

Reported cases are few, De Lee recording one specimen shown at the Chicago Gynecological Society where two extra-uterine pregnancies of different dates had been removed at operation.

Abdominal Pregnancy.—The recent literature contains constantly increasing numbers of case reports dealing with this interesting condition. From the very nature of the condition, bizarre and dramatic findings are to be expected and the anticipation of such phenomena is not infrequently exceeded by the exposure of the lesion present. Reported cases of abdominal pregnancy should always include a detailed account of the location and attachment of the placenta and the method of dealing with it since this phase of the subject is not completely settled yet and requires the cumulative experience of many obstetricians to determine the optimum procedure.

The tendency is steadily growing to regard the placenta as a digestible, autogenous tissue mass and to leave it undisturbed, the child and membranes as well as any pathological pelvic organs being removed and the abdomen closed without drainage.

Many clinical observations seem to substantiate the view that this way of handling the placenta offers the lowest mortality yet achieved and immeasurably reduces the maternal morbidity since the older plans of marsupialization with slow necrosis and sloughing of the placenta predicate many weeks of hospitalization and a high incidence of terminal defect of the abdominal parietes, subsequent operation being necessary to repair the herniæ.

In Jewett's case (*Am. J. Obst. & Gynec.*, 1923, 5: 176), the placenta was very large and was firmly attached to the right side of the posterior surface of the uterus, the right broad ligament extending into the culdesac and up on the posterior pelvic wall as far as the brim of the pelvis overlying the iliac vessels of that side. As it was evident that removal must be attended by serious hemorrhage, the placenta was left *in situ*, the cord ligated and cut close to its insertion. The patient made an uneventful recovery and left the hospital in two weeks. Pelvic examination at frequent intervals showed a gradual decrease in the size of the placenta, during the first six months after the operation, but no apparent diminution during the next six months. It was, however,

more movable in the pelvis and much less sensitive. The patient appeared to be perfectly well.

While it is not yet time to lay down a definite rule, it would seem that in uninfected patients, the abdominally situated ectopic placenta will undergo at least partial absorption and that it is not a source of great danger to the patient if left *in situ* and the abdomen closed. On the other hand, attempts at its removal are often fraught with such grave danger from hemorrhage while the old plan of marsupialization, stitching the peritoneum around the placenta and packing the cavity with gauze, carries with it such certainty of prolonged convalescence, infection of the sloughing mass and probability of a permanent damage to the integrity of the abdominal wall, that almost any plan of treatment would seem preferable. The leaving of the placenta, with, possibly, a second operation to remove the unabsorbed remainder, after some months have elapsed, seems to offer the best solution as yet devised.

Two Abdominal Pregnancies in the Same Patient, Following Supravaginal Hysterectomy.—McMillan (*West Va. M. J.*, 1921, 16: 183) reports a case in which a supravaginal hysterectomy was performed for infection in a patient 18 years of age. The right ovary and about 1½ inches of the distal end of the right tube were left in. Eighteen months later abdominal pregnancy was diagnosed and upon section a recently dead infant of 8½ pounds weight was found enveloped in its ruptured amniotic sac. The placenta was situated in the left flank under the spleen and was slowly separated. Twelve months later this patient reported with a second pregnancy which proceeded until the seventh month, when a 4-pound dead infant was removed by section. Hemorrhage resulted in the death of the mother.

Diagnosis of Tubal Pregnancy.—*New Diagnostic Signs.*—Sudden Acute Pain in the Shoulder, Indicating Subphrenic Blood Extravasation.—Rubin (*J. Am. M. Ass.*, 1923, 80: 1050) states that the shoulder pains so commonly noted as accompanying artificial subphrenic pneumoperitoneum are comparable to those due to the sudden accumulation of fluid in the subphrenic space. The pain produced in the diaphragmatic area is referred to the shoulders by sensitized cutaneous nerves of the cervical segments, the phrenic nerve having its origin in the third, fourth, and fifth cervical cord segments and connecting with cervical peripheral nerves supplying the shoulder-girdle.

In ruptured ectopic pregnancies with extensive hemoperitoneum, bilateral shoulder pains are present but affect more intensely the shoulder corresponding to the side of the tubal rupture.

When the hemorrhage is not extensive and is confined to one side, the shoulder pain will indicate the side of the rupture. This sign should be extremely valuable if continued observation corroborates the findings. In the experience of the writer, patients with massive hemorrhage are usually very ill and in shock and, despite careful history-taking, he has been unable to elicit this symptom except in very scattered instances. When the hemorrhage was small he was only once able to get a report of shoulder pain from a patient.

Bluish Discoloration about the Umbilicus; Cullen's Sign.—This interesting phenomenon to which attention has been directed elsewhere in this book, is being occasionally noted, but with no degree of uniformity.

In an analysis of 50 cases of ectopic pregnancy operated upon recently at Johns Hopkins Hospital, Brady found no evidence of this sign (*Johns Hopkins Hosp. Bull.*, 1923, 34: 152). The author has reported a case wherein the bluish discoloration about the umbilicus was very marked, and was regarded as corroborative of the diagnosis of ectopic pregnancy which was based upon a highly suggestive symptom-complex. At operation there was found a normal intra-uterine pregnancy and bilateral acute purulent salpingitis, there being no blood present in the abdominal cavity at all (E. A. Schumann, *Am. J. Obst. & Gynec.*, 1923, 6: 632). In view of these findings, it follows that, while an interesting and suggestive observation, periumbilical ecchymosis is not in any sense pathognomonic of abdominal hemorrhage nor does its absence weaken such diagnosis in any given case.

Chemical Tests for Ectopic Pregnancy.—Phlorizin glycosuria has been used to some extent as a test for pregnancy, glycosuria appearing in most pregnant women a half hour after the injection; in the first half of pregnancy the reaction is more readily positive than in the second half. Paruzza finds this test a most valuable one in determining the existence of extra-uterine pregnancy (*Riv. di ostet. e ginec. prat.*, Palermo, 1924, 6: 76).

In doubtful cases the positive phlorizin reaction may contribute to point the way to an exact evaluation of the syndrome of ectopic gestation. Paruzza cites 4 cases in which this test was strongly positive while the ovum was still uninjured or immediately after rupture but became negative in the presence of hematoceles attending the definite termination of an extra-uterine pregnancy.

These observations are extremely important and should be verified and their degree of accuracy determined upon.

Treatment.—No radical change in the treatment of ectopic pregnancy has been offered, although the trend against deferred operation seems to be steadily growing, the majority of these reporting series of cases advocating immediate operation in all cases.

The propriety of removing the affected tube or, if possible, of conserving it, removing the ovum and resecting the diseased portion of the tube is still under discussion. Cases of normal pregnancies following salpingotomy are recorded, but in final analysis it appears that the danger of repeated tubal gestation so outweighs the probabilities of normal pregnancy in these cases that salpingectomy is the procedure of choice except when, the remaining tube being absent or hopelessly diseased, the patient elects to retain even the remote possibility of future childbearing.

Reinfusion of Blood.—The infusion of the free blood found in the peritoneal cavity in cases of ruptured ectopic pregnancy directly back into the blood stream has been performed in a number of instances, most operators describing their results as excellent. In a very complete paper Klopp (*Tr. Am. Surg. Ass.*, 1922, 40: 203) reviews the subject, reporting 11 cases of his own. Thies of Leipzig appears to have first suggested this procedure (*Zentralbl. f. Gynäk.*,

1914, 38:34:1191) of collecting the blood from a ruptured extra-uterine pregnancy with a spoon, straining it through double-ply muslin and diluting with salt solution in the proportion of 3 to 2. Thies's 3 patients recovered with uneventful convalescence.

Before applying the method the blood found in other cases free in the abdominal cavity had been examined and found sterile, and the erythrocytes were unimpaired.

This paper was followed by those of Lichtenstein, Armin, Topler, and many others. (For a complete survey of the literature see Klopp's paper quoted above.)

The technic according to Klopp is to bail the blood out of the abdominal cavity with a cup and transfer it to a graduate placed in a water-bath. The cubital veins having been prepared, a cannula is inserted and, after running a small quantity of salt solution into the vein through a funnel, the blood is strained through six-ply fine-meshed gauze, directly into the funnel. Citration seems to be unnecessary. In Klopp's cases the amount of blood reinfused varied from 300 to 900 c.c. This author concludes that reinfusion should not be used routinely in cases of ruptured ectopic pregnancy, but should be employed in the cases in which the loss of blood has caused desperate symptoms.

Zimmermann (*Ztschr. f. Geburtsh. u. Gynäk.*, 1921, 84:355) believes one should take advantage of the resorptive power of the peritoneum in cases of intra-abdominal hemorrhage.

In instances of non-infected intraperitoneal blood effusion during tubal pregnancy it is advised that clots be removed, leaving the fluid blood intact. The latter is defibrinated and therefore no longer coagulates and is rapidly and completely resorbed, so that the majority of the erythrocytes reach the general circulation in a state of good functional ability. Intravenous transfusion of the effused blood should only be carried out when the condition of the patient becomes grave during the operative procedures.

In as much as reinfusion is considered as indicated only when the blood loss is great, it seems that the loss of time necessary to bail out any appreciable amount of blood from the abdomen will more than offset any advantage gained. Furthermore, since this blood is defibrinated and therefore has no further value in inducing coagulation, so necessary a factor where severe hemorrhage has taken place, the procedure is of but little value, in the opinion of the writer.

A very rapid operation, leaving as much of the free blood as may be in the abdomen for its future resorption, together with the prompt transfusion of fresh blood from a properly selected donor offers far greater probabilities of success.

In addition, while no instances of bacteriemia are recorded as following the reinfusion of blood, the necessary manipulation will certainly increase the danger of the contamination of the blood so utilized.

During the period since publication of the first Appendix, considerable literature has accumulated regarding this condition, but the contributions are largely reports of interesting cases and technical details as to operation to-

gether with some detailed work upon the anatomy of the lesion. There have been no innovations or decided changes as to the general principles involved.

The Sedimentation Test in Ectopic Pregnancy.—Ever since Friedlander of Detroit called the attention of American gynecologists to the value of the sedimentation test, there has been a steady accumulation of data concerning it. In general it appears that in unruptured ectopic pregnancy, the sedimentation time is but little reduced from the normal, if at all, and therefore the test offers valuable information as to the differentiation between unruptured ectopic pregnancy and salpingitis.

However, in the far more common group of ruptured tubal pregnancy the test has but little value since the time is greatly lessened and is closely analogous to the results found in acute salpingitis. Such cases must, therefore, be diagnosed by other means.

The Leukocyte Count in Ectopic Pregnancy.—Repeated, careful leukocyte estimations are undoubtedly of great value in estimating the degree of damage to the tissues involved and the amount of hemorrhage. Farrar (*Tr. Am. Gynec. Soc.*, 1925) has made a careful study of this subject in 150 cases and reaches the following conclusions:

1. In ectopic gestation the leukocyte count fluctuates according to the amount of fresh blood being thrown into the peritoneal cavity and the rate of absorption.

2. The leukocyte count tends to drop quickly to normal as the blood in the peritoneal cavity is absorbed or walled in; 48 per cent of 150 cases of ectopic gestation had a normal leukocyte count before operation.

3. The leukocyte count was normal in 29 cases of unruptured tubal pregnancy where there was no free blood, and in 43 cases of ruptured pregnancy where the blood was walled in.

The leukocyte count was an index in 150 cases to the amount of free blood in the peritoneal cavity, and the polymorphonuclear leukocyte count was increased markedly only in cases having fresh blood in the pelvis and was in direct ratio to the amount of recent blood found at the time of operation.

5. The fluctuating leukocyte count together with the moderate elevation of temperature differentiates ectopic gestation from a purulent salpingitis with its more uniformly high leukocyte count and fluctuating temperature.

6. In cases of rupture of tubal pregnancy the steadily rising leukocyte count indicates active bleeding before the fall in the number of red cells of hemoglobin gives warning of the condition.

7. The leukocyte count to be of diagnostic value must be taken at least daily, and in critical cases even hourly, and used in conjunction with the history and clinical findings in the case.

CESAREAN SECTION

SUPPLEMENTARY CONTRIBUTION

BY

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The literature on cesarean section has been reviewed from 1921 to date. A great many papers on this subject have been published during this period. There was considerable repetition. Only what were thought to be the most important articles could be reviewed in the space allotted to this chapter.

The review on cesarean section will be taken up under the following headings:

1. Indications
2. Classical cesarean section
3. Mortality in cesarean section
4. The uterine scar and rupture of the uterus after cesarean section
5. Cesarean section under spinal anesthesia
6. Cesarean section under local anesthesia
7. Porro's cesarean section, or cesarean section followed by hysterectomy
8. Cesarean section followed by temporary exteriorization of the uterus
9. Cervical cesarean section
   (*a*) Longitudinal incision
   (*b*) Transverse incision
10. Vaginal cesarean section

Indications.—The indications for cesarean section have become rather more complex than those given by Murphy when writing on the subject in 1862. He gave the following reasons why the operation should be performed:

1. In the ovate deformity of the pelvis, when the conjugate axis is less than 2 inches.

2. In the cordiform distortion from mollities ossium when the distortion is extreme and craniotomy is either impracticable or so difficult that the safety of the mother cannot be secured.

3. When tumors are immovable, or so occupy the pelvic cavity as to leave space of only 2 inches between the tumor and the pelvis.

The tendency of the last few years has been to limit rather than to increase the indications of cesarean section. Obstetricians are realizing more and more that cesarean section is not a panacea for all obstetric ills.

Burnell [1] stated that during his service as Resident Obstetrician and Gynecologist in the Long Island College Hospital, Brooklyn, over 100 cesarean sections were performed. The gross indications were as follows: Placenta prævia, 4; obstruction from pelvic tumors, 6; decompensated cardiac cases, 6; eclampsia, 6; malposition of the fetus (posterior face and transverse), 11; malformations of the uterus, 3; primiparæ with contracted pelvis, 32; multiparæ with contracted pelvis, 17; postoperative dystocia, 9; previous cesarean section, 6. He takes up in detail each of the indications in the series reported.

Davidson [2] wrote that before undertaking cesarean section for a relative indication certain conditions should be present to insure a successful outcome:

1. The child should be alive and in good condition.
2. The patient must be in good condition physically, not exhausted by long labor, not infected by previous vaginal examinations or previous attempts at delivery.
3. She must be in a hospital or equally good surroundings for a major operation.

As *pelvic conditions* he mentions kyphosis of the spine, coxalgic pelvis, transversely contracted pelvis, pelvic exostoses, osteomalacic pelvis, tumors of the pelvis and old fractures of the pelvis.

Among the non-pelvic indications for cesarean section the following are cited: Fibroids, cancer of the cervix, ovarian tumors, rarely abdominal tumors or tumors of the vagina. Atresia of the vagina may become an absolute indication. A previous complete tear through the rectum which has been primarily or secondarily repaired frequently becomes a relative indication for cesarean section.

He raises the question of "once a cesarean section, always a cesarean section," and states that Barton Cooke Hirst, at the Southern Association meeting in November, 1924, answered this question to his own satisfaction by stating that when he has performed an operation himself, he has no fear in letting the woman deliver herself subsequently, if there is no other contraindication. If there has been evidence of infection following the operation, or if great care has not been taken in suturing the uterus, it is safer to do another cesarean rather than run the risk of ruptured uterus.

Eclampsia is mentioned to say that the mortality has been so great that the conservative methods of treatment are considered by the majority to be the safer.

Placenta prævia of the marginal type is not an indication for cesarean section, and is better treated by doing a version, but placenta prævia centralis, especially in a primipara at or near term, is now considered by many an absolute indication for cesarean section.

Premature separation of the normally situated placenta, mitral stenosis, aortic valvular lesions and myocarditis render pregnancy and labor very dangerous, and abdominal delivery before the onset of labor offers a better prognosis in a number of cases.

Donovan [3] considers, besides the above-named indications, chronic nephritis, septic condition of the genital region, uterine inertia and breech presentation in primiparæ. These are open for discussion, and many operators would not subscribe to them, especially breech presentation in a primipara. In the absence of a pelvic contraction or of marked disproportion a breech delivery through the parturient canal is not a very difficult procedure, and most breech cases are still delivered that way.

About exophthalmic goiter Donovan continues: "Much the same reasoning and indications apply in exophthalmic goiter as in diseases of the heart, but there is an added toxic element. The patients do not tolerate the anesthesia well, but stand the strain of labor still less well. The only two patients for whom I have performed cesarean section on account of this condition, in both it was very severe, stood the anesthesia well. As showing the effect of labor in the condition the pulse rate of one of these patients rose twenty beats in the first two hours of labor. I look upon exophthalmic goiter in late pregnancy as a positive indication for cesarean section. The time at which it should be performed depends on the result of absolute rest in bed. If the patient improves, operation should be postponed to near calculated term in order to increase the chances of the child."

Ballantyne [4, 5] reviewed the literature for the years 1918, 1919, 1920, with a few references to 1917 and 1921 cases. He reviewed the literature on placenta prævia and felt that cesarean section is likely to be chosen in only a few cases of placenta prævia, and that especially of the central variety in primiparæ. He realizes that without cervical dilatation it is not always possible to determine the central position of the placental insertion. When cesarean has to be decided upon, "whatever be the sphere of its usefulness in the future, there can be no doubt that in many quarters at the present time there are signs of a revolt against the practice of so often sacrificing babies by making these babies plugs to save their mothers' lives."

In his series of cesarean sections in recent years, he has operated once for placenta prævia with a successful result, in a second case the circumstances were favorable but a chance prevented him doing so, and since the fetus turned out to be anencephalic, there was no room left for regret.

Accidental Hemorrhage.—Ballantyne feels that the field of cesarean section in cases of accidental hemorrhage is even more restricted than that in placenta prævia. This opinion is not entirely in accord with that of American operators, for the reviewer has gathered the impression from the papers written in the last seven years that accidental hemorrhage, at least in the United States, is gaining ground as an indication for abdominal delivery.

Eclampsia he summarizes as follows: "Notwithstanding some marked exceptions, the general tendency at the present time is to pass away from the cesarean section as the ideal treatment for eclampsia, and, should adequate supervision of pregnancy and medical measures in the pre-eclamptic state prove useful, the tendency will become still more marked up to the degree of abandonment. Much depends, of course, on the discovery of the real cause of eclampsia, should it be established that it is something formed in the fetus

or placenta, the arguments for the rapid emptying of the uterus will be reinforced and cesarean section and other operative measures will again come to the front." He has not done a section either for preëclamptic state or for eclampsia, for he holds firmly to the dictum that the fits and the toxemia should be treated and the pregnancy left alone.

Rare Indications for Cesarean Section.—He discusses pelvic causes as pelvic contraction and deformity. Among the non-pelvic causes he mentions placenta prævia, accidental hemorrhage, and eclampsia as having already been discussed. In addition, heart disease, ventral fixation, neglected transverse presentation, face cases, occipitoposterior positions, breech presentation in the elderly primipara, ovarian cysts, fibroids, atresia of the cervix, malignant cysts, growths of the uterus and neighborhood, and states that these indications must be regarded as extremely rare.

Uterus, didelphys, contracted pelvis, double uterus, and multiple fibroids, hydramnion, ascites, and an ovarian cyst with a twisted pedicle wedged into the pouch of Douglas, peritonitis situated around the vermiform appendix, retention of the fetal head after decapitation, vaginal varicose veins, previous large infants have been collected in the literature by Ballantyne as rare indications.

Greenhill [6, 7] performed cesarean section, "laparotrachelotomy," in a primipara 26 years old for enormous edema of the vulva in the presence of a very large child.

The dystrophia dystocia syndrome as an indication for cesarean section is taken up by Greenhill. He gives 6 case reports, all patients having been delivered by the transperitoneal cervical cesarean section, and one case showing the bad results of so-called conservative treatment.

Under this syndrome Greenhill included gravidæ revealing certain masculine characteristics, or evidence of hyperpituitarism. There may be a wide distribution of hair, a masculine form of face and extremities, and a masculine pelvis with thick heavy bones and narrow pubic arch. In general the pelvis is slightly contracted. Most of the women are rather short and stout. They have short forearms and short stubby fingers, but large wrists and ankles. Most of them go over term. At the time of labor the pains are generally weak and irregular and may last for days without any progress being noted. The vertex usually presents as a posterior occiput and it remains high in the pelvis. Not infrequently the breech is the presenting part. The membranes often rupture early in labor and the cervix dilates very slowly. These patients frequently have only one pregnancy, and it is important that a live baby be delivered, especially because the added risk of cesarean to the mother is slight.

Kerr,[8] in a paper entitled "Indications for Cesarean Section," took up the following: Contracted pelvis, fibromyomata, ovarian cystomata and other tumors, such as broad ligament cysts, malignant ovarian tumors, tumors of the pelvis, tumors of the pelvic colon and rectum, and carcinomata of the cervix. In eclampsia he states that "the causes suitable for cesarean section are those in which the pregnancy is well advanced but in which there is no dilatation of the cervix or attempt at labor, and where after six hours, there is no improve-

ment from blood letting, intravenous saline infusion and morphine. Where the seizures occur earlier in pregnancy than the thirty-second or thirty-third week vaginal cesarean section is preferable."

Placenta prævia, accidental hemorrhage, ventrofixed uterus, interposition of the uterus, prolapse of the cord, impacted shoulder presentation, abnormal conditions in the child, retraction and contraction rings, rigidity of the cervix and vagina, and grave diseases threatening the life of the mother are discussed from the standpoint of indications.

Liepman [9] reported a case in which vulval eczema and placenta prævia were the indications for cesarean section. Intraperitoneal cervical cesarean section was performed. The mother and child were discharged well.

Dougal [10, 11] performed cesarean section for labor obstructed by the non-gravid horn of a double uterus in a woman of 33, a primigravida, two days after commencement of labor pains, which were weak and infrequent. The child presented by the breech, but the lie was rather oblique and a soft mass could be felt lying at the brim of the pelvis on the left side and displacing the presenting part. No progress was made in twenty-four hours. Cesarean section was done with a living child. Pregnancy had occurred in the right horn of a uterus bicornis unicollis, and the left horn, enlarged to the size of a three months pregnancy, lay at the level of the pelvic brim. Good recoveries.

Dougal also did a cesarean section for adhesions between the anterior uterine and abdominal walls obstructing labor and following an abdominal myomectomy.

Guy [12] performed cesarean section for pregnancy in a double uterus.

Johnstone [13, 14] for thoracopagus twins in one case and for advanced rectal cancer in another.

Taylor,[15] in a paper entitled "Cesarean Section, with Special Reference to Present Day Indications for Operation," reviewed all the indications given above.

Paton [16] reported a case of cesarean section for prolapsed cord. Pfeiffer [26] had to do a cesarean section following the Coffey plication of the round and broad ligaments. Phillips [17] reported 2 cases of cesarean section for pregnancy in a uterus bicornis unicollis; Shaw [18] for a slightly contracted pelvis combined with rectovaginal fistula; White [19] for double lobar pneumonia, one under spinal anesthesia, in which the mother and child recovered, and another for osteoma of the broad ligament; and Whitehouse [20] for sacculation of the uterus.

Rivière [21] reported 4 classical cesarean sections for what he terms unusual indications:

1. In the first, the indication was prolapse of the cord in a secundipara, before dilatation and in the presence of a slightly contracted pelvis.

2. In the second case, the indication was adherent retroflexed uterus at term. This operation was followed by hysterectomy.

3. In the third, the indication was intestinal obstruction of paralytic origin in a primipara at term.

4. In the fourth case, the indication was non-neoplastic rigidity of the cervix in a primipara.

Léon Valois [22] reported a cesarean section on a secundigravida, 28, for prolapse of the cord, without dilatation.

Laffont and Jahier [23] reported a cesarean section where a uterus infraseptus unicorporeus was the indication.

Siegel [24] asked the question whether the surgeon is justified in performing prophylactic cesarean section in the interest of the child in cases in which there is 80 per cent of probability of normal delivery through a moderately contracted pelvis. As arguments against the practice, he mentions the following:

1. Even though the mortality rate has been greatly reduced, it still does exist and will never be zero.

2. The morbidity of cesarean section is higher than that of natural delivery even with forceps, version, perforations, etc.

3. What will be the effect on later deliveries?

In answer to this last question Siegel gives statistics from his clinic. These apply to 113 women on whom first cesarean section was performed, and whose cases were followed up for a number of years (average six years). Of the 113, 59 became victims of secondary sterility, 28 had normal later deliveries, and in 26 cesarean section had to be repeated. Two became pregnant a third time, one was delivered spontaneously, the other by cesarean sction. In contracted pelvis, even of first and second degree, there is a probability of 2 to 3 that in the next pregnancy cesarean section will again be necessary, and it is almost certain that it will be necessary in the third, but maternal mortality increases from 4.2 per cent in the first section to 11 per cent in the second and to 28 per cent in the third section or delivery, as the case may be. To excuse this relatively high maternal mortality some authors point out the number of infants saved to society by this procedure, but Siegel says they do not take into account the loss due to secondary sterility caused by this operation. For these reasons he thinks that indications for cesarean section should be very carefully determined and reduced to a minimum. There are cases in which it is unavoidable, such cases for instance as women with pelvic contraction of first or second degree who have passed a certain age, whose soft parts are rigid, who have been sterile for a number of years, and in whom the possibility of later conception is very slight. Likewise in multiparæ who have had a number of stillbirths, or other unfortunate deliveries (but here the obstetrician must not rely merely upon the statement of the patient, which might be highly subjective, but should get in touch with the physician who attended her at the time of such previous deliveries, and ascertain, if possible, the causes responsible for the difficulties).

Zanetti [25] in the discussions on the treatment of placenta prævia, in the Twenty-Second Congress of the Italian Society of Obstetrics and Gynecology (1923), stated that it appeared that cesarean section was acquiring greater importance. He wrote that, in 1924, Viana collected 191 cases of placenta

prævia treated by cesarean section in various Italian clinics. In 75 per cent there was central placenta prævia. The total mortality was 11.4 per cent for the mothers and 23.2 per cent for the infants. Zanetti reported a case with grave anemia. The child was dead previous to the intervention. Postoperative course of the mother was normal. Other interventions, such as penetration of the placenta, are excluded because of the danger of loss of blood in such cases.

CLASSICAL CESAREAN SECTION

In the review of the literature of the last seven years, no great contribution has been made about the classical operation, except for the fact that many operators have found it unsatisfactory in comparison with the low cervical cesarean, and it is slowly but gradually being replaced by the latter method. The discussion about the classical type of operation centers largely on the question of abdominal incision. In this, there is nothing new as this discussion has been going on for years. Some are in favor of the low incision between the symphysis and umbilicus as recommended by Newell. Others advise the high incision above the umbilicus, introduced by Asa B. Davis, while still others advocate the right or left incision using the umbilicus as a mid-point. The question of uterine suture is taken up in almost all of the papers read. Here again, catgut, linen and silk find their supporters, some using a non-absorbable suture such as linen or silk in the muscularis and catgut in the serosa, while the majority recommend catgut entirely. The question of how many layers of suture should be made in closing the uterine incision is not any nearer standardization than it was years ago, thus we see the advocacy of one layer, two layers, three layers and even four layers. Again, certain authors recommend interrupted sutures, while others favor continuous sutures, and still others use a combination of the two. Practically all the writers are of the opinion that the uterine mucosa should be skipped in introducing the sutures. O. C. Cox,[27] writing on the subject, advocates the closure of the endometrium in cesarean section and presents many sound reasons backed up by experience why this should be done. His paper is short and is quoted in its entirety, as it throws a new light on the much discussed question:

Rupture of the uterus during subsequent pregnancies and intestinal obstructions at any time from one week to twenty-three years after, are the real dangers of cesarean section. Probably infection plays a part in causing these unfortunate occurrences. With modern operating room technique and with patients who have not been subjected to vaginal examinations, there should be a minimum of infection. However, the reports of these two disasters are increasing constantly in number.

It can be understood readily how it is difficult to hold with sutures a wound in a muscular organ, that is alternately contracting and relaxing. Particularly is this true in the puerperal uterus, because during involution there is rapid and marked diminution in the size of the whole muscular structure. This is by some process not exactly understood, and it is plausible that this very process of involution impedes healing of the muscle fibers. If aseptic technique is carried out perfectly and yet we have rupture of the uterus, must we not look for some other fault?

Let us examine the method of suturing. In descriptions of the classical cesarean section the sutures are placed in the myometrium and peritoneum. It is always stressed not to sew the endometrium. The reasons for not sewing the endometrium are not good, but there are many excellent reasons for sewing it. No other epithelial lined organ is closed without the mucosa first being sewed, then why not close the uterine mucosa with a continuous fine chromic suture? The wound in the uterine musculature can be wiped clean and closed without blood entering it from the interior of the uterus. It is well known that a few days after labor, all uteri harbor bacteria. If the mucosa is closed accurately, it will heal tightly in a few hours, thus protecting the sutured muscle. When the mucosa is not closed and the uterus is sutured in the usual manner, there is an eversion of the edges of the mucosa. The muscular fibers of the line of suture are brought into contact with the bacteria laden lochia. Consequently a thin scar of fibrous tissue and peritoneum is the result. Interrupted stitches leave too many knots in the wound. Knots are slow to be absorbed, cause serum to collect around them, and are likely to be extruded into the uterine cavity.

I have used the following method of closure in several cesarean sections, and believe it to be superior to the methods described in most texts.

1. The mucosa is closed with continuous No. 1 chromic catgut.
2. The uterine muscle is closed with two layers of continuous No. 2 chromic catgut, very deep bites into the muscle being taken.
3. The peritoneum is closed with No. 0 chromic catgut and the Lembert stitch is used in making the suture.

Thus, the muscle layer is sealed between sutured mucosa and sutured serosa.

Thom [28] reported four classical cesarean sections on one patient, a colored woman, who had been delivered of two living children through the pelvis before the first operation. The first cesarean was done after seventy-two hours of labor for non-engagement. The convalescence was normal. The second hysterotomy was performed a year later after a trial labor, and again the convalescence was normal. Still a year later a third operation was performed, the omentum was found adherent to the parietal peritoneum and uterine scar; the placenta was adherent to the uterine scar. The convalescence was normal and the blood Wassermann test which was done at the time was negative. After another year the fourth section was performed. Adhesions involving the peritoneum, omentum, intestines and anterior surface of the uterus were found. The placenta was again implanted on the old scar. *The uterine wall was abnormally thin in the region of the scar.* He stated that the extreme thinness of the uterine wall, at the site of the previous scar, may have been due to: (*a*) Excavation due to poor union at the previous operations; (*b*) thinning out due to intra-uterine pressure at the time of labor; (*c*) syncytial erosion. It seems reasonable to suppose that all three processes may have shared in the condition. He feels that the case emphasizes the fact that the cesareanized woman needs extra and constant medical supervision during the last month of pregnancy. Because the puerperium following cesarean section is unattended by fever or other manifestations of infection is it

not assuming too much to claim that the scar in such instances is perfectly healed and will stand an equal amount of strain with any other portion of the uterine wall? He concluded by stating that the knowledge of the implantation of the placenta and of the condition of the scar would greatly strengthen our position in regard to our treatment of the cesareanized woman.

Gasper [29] reported the case of a 26-year-old quartipara who had given birth to three babies without trouble. She was in labor many hours with fully dilated os and several ineffectual attempts to deliver with forceps before the condition was recognized and the patient sent to a hospital. Classical cesarean section was done although he stated that it was their intention to do a De Lee operation. The uterus was not removed because the fast sinking patient demanded haste. She died of septicemia.

Hirst and Van Dolsen [30] in writing on cesarean section stated that "the risk of cesarean section is in direct ratio to four factors: (1) the length of time the patient has been in labor; (2) the length of time the membranes have been ruptured; (3) the number and technique of vaginal examinations made; (4) previous attempts at vaginal delivery by forceps.

"In an elective case, in competent hands before the patient has fallen in labor, the risk is negligible. All the foregoing factors increase the risk enormously. Whatever may be thought of rectal examinations as a routine procedure, they are desirable and should be performed in any case undergoing a test of labor, as a preliminary to a possible cesarean section later in the course of labor." They described their closure of the uterine incision in three layers with continuous sutures of catgut.

Williams,[31] in a paper entitled "A Critical Analysis of Twenty-one Years' Experience with Cesarean Section," gave the following conclusions:

1. This analysis is based upon 183 cesarean sections performed upon 145 women up to December, 1920.

2. The operations were done in a series of approximately 20,000 deliveries and comprised 104 single and 79 repeated sections. The latter were done upon 41 women, 34 of whom had two, and 7 three sections each.

3. Although the number of white and black patients in the service was approximately identical, many more cesarean sections were done upon the latter—114 to 169, while 30 to 11 required repeated sections.

4. The following types of operations were done:

121 typical conservative sections
4 extraperitoneal sections
1 postmortem section
57 Porro sections

5. The gross mortality was 5.46 per cent but upon deducting the cases in which death was not attributable to the operation, the net mortality was 3.45 per cent, or 4.07 per cent in the conservative and 1.82 per cent in Porro sections. All deaths, except one from hemorrhage, were due to infection.

6. The mortality was 13 times greater in the first 50 than in the last 133 cases—10 to 0.77 per cent. This remarkable diminution was not due to changes in operative technique, but to the avoidance of ascending infection by operating before the onset or during the first hours of labor.

7. The conservative section late in labor is always dangerous, even if vaginal examinations have not been made, while the Porro section is relatively safe. The most important means of lowering the mortality of conservative cesarean section due to disproportion is by learning to determine before the onset of labor whether operation will be required or not.

8. The Porro operation is relatively safe even in infected or exhausted patients, as the absence of the involuting uterus hinders the spread of infection.

9. Disproportion due to contracted pelvis was the indication for interference in nine-tenths of the black, and in six-tenths of the white patients.

10. The several varieties of rachitic pelvis afforded the predominant indication in the blacks, as compared with the simple flat pelvis in the whites.

11. The most frequent non-pelvic indications were eclampsia and serious cardiac decompensation.

12. Cesarean section is not the ideal treatment for eclampsia, and is indicated only in the rare instances in which the cervix is rigid and undilated and venesection has not led to improvement.

13. It is likewise only rarely indicated in placenta prævia. We have done but one section in 66 cases, and regard the rubber balloon as the best treatment.

14. Generally speaking the patient should be sterilized at the third section, either by amputating the uterus or by an operation upon the tubes.

15. We make the abdominal incision below the umbilicus as it permits amputation of the uterus or operations upon the appendages when necessary, without extending the incision.

16. The uterus should be incised *in situ,* and eviscerated before incision only in the presence of infection. Our experience indicates that in normal cases the latter procedure increases the incidence of infection.

17. The uterine incision should be sutured in layers and the greatest care taken to insure the closest approximation of the peritoneal margins.

18. The uterine cicatrix ruptured once in 48 women with repeated sections, as well as in 12 deliveries through the natural passages subsequent to section. The frequency of its occurrence is probably exaggerated, so that the dictum "once a cesarean always a cesarean" is not necessarily correct. On the other hand, the possibility of rupture must always be faced and constitutes the strongest argument against the unnecessary employment of cesarean section for non-pelvic indications.

19. The placenta was inserted upon the anterior wall of the uterus in two out of every five of our cases. Consequently it is frequently involved in the uterine incision. This has no other significance than a momentary gush of blood.

20. The delivery of an asphyxiated child occurs less frequently than is generally believed. Somewhat over one-half of our children cried immediately after delivery, and only 7 per cent were deeply asphyxiated.

21. Notwithstanding the extraordinary value of pituitary extract in stimulating uterine contraction, pronounced atony with danger of death from hemorrhage is still to be reckoned with, and necessitated amputation of the uterus in two of our patients.

22. Uterine adhesions were absent in one-quarter of our repeated sections, and were extensive in one-third of them. They are not necessarily the result of infection, as the puerperium was normal in 36 per cent of the cases in which they developed. In many instances they appear to be associated with imperfect approximation of the uterine wound or with other traumatic factors.

23. The old superstition that boys originate from the right and girls from the left ovary can be definitely discarded. In two-thirds of our patients the corpus luteum persisted until the end of pregnancy and its location bore no relation to the sex of the child.

24. Finally it should be remembered that cesarean section is not devoid of danger, and is relatively safe only when done under appropriate conditions before the onset or during the first hours of labor.

As the uterine cicatrix constitutes a locus minoris resistentiæ in subsequent pregnancies, cesarean section for other than pelvic indications should be performed only when absolutely necessary.

It is my conviction that the operation is being abused throughout the country and if accurate statistics as to its results were available that it would be found to be accountable for many unnecessary maternal deaths.

It should be recognized that, although it is frequently the easiest manner of delivering the patient in the presence of various anomalies, it is not always the safest, and that ideal results are obtained in only a few clinics.

Foster [32] described a new technic in performing the classical cesarean section. He makes a long median incision extending from the umbilicus to the pubic crest. The incision is made in the anterior surface of the uterus. The incision is closed in two layers with No. 2 chromic catgut; the first layer consists of interrupted sutures skipping the endometrium, the second of mattress-sutures burying the first plane. The parietal peritoneum is then sutured to the uterus all around the closed uterine incision and the rest of the abdominal wall is closed in layers. By this method he claims that subsequent operations may be done extraperitoneally, by going through the same space. This operation, in the reviewer's opinion, presents all the disadvantages of the classical operation and none of the advantages of the low retrovesical operation.

Cameron [33] related briefly the technic which enabled him in 107 successive cases of cesarean section in rachitic subjects to bring the mortality in his practice to under 1 per cent.

Every surgeon who has had a large experience in dealing with cases of repeated cesarean section has probably been hampered on several occasions by numerous and dense adhesions in the region of the former scar or scars. The attachment of the uterus to the parietes can often be diagnosed before the abdomen is opened, owing to movements communicated to the uterus being accompanied by in-dragging of the abdominal wall.

In treating adherent cases, Cameron strongly advocates the practice of evacuating the uterine contents through transverse incisions in the abdominal and uterine walls. By so doing the labyrinth of adhesions may be avoided, and as the uterus is usually tightly fixed to the parietal peritoneum the organ remains there in a state of ventrosuspension. It is probable that the attachment of the uterus to the parietes favors incomplete retraction. Catgut is relied upon entirely as, when properly prepared, it holds the tissues in apposition as efficiently as silk, and has the advantage of disappearing within three weeks. If union of the various elements has not taken place by that time it never will. He is of the opinion that all interrupted sutures lie loosely in tissues after

a few days and so silk does not keep the tissues more firmly lashed together than catgut. The free use of silk within the abdomen seems unjustifiable, as the presence of this durable material may readily lead to the formation of dense adhesions, and, moreover, it may be the cause of great misery if it becomes infected as a persistent sinus forms. Each month the unhappy woman menstruates on to the abdominal wall. Vesical calculi may also originate from silk sutures in the uterus having made their way through the wall of the bladder.

Lawrence [34] considered the numerous methods of performing the classical cesarean operation and the present enlarged field of its application, the danger of distant sequelæ that are not often thought of when operating, must be reckoned with, including disturbances due to adhesions and rupture of the uterus in subsequent spontaneous labors.

The technic here described was devised for the purpose and in the hope of avoiding these sequelæ. It was thought, if a technic could be developed which would decrease the length of the incision, perfect union of the incised musculature of the uterus, and eliminate or diminish adhesions, then with correct selection of cases and changes in postoperative handling these dangers might be mitigated.

Experiments in technic were made in 1919 using that then employed by William E. Parke as a starting point. Parke and others then employed the high-low incision and a three-tier closure of the uterus, approximating the uterine reflection of the peritoneum by means of an exposed mattress-suture. After a variety of experiments throughout 1919, the technic here reported was devised and has been employed continuously since then, whenever the classical cesarean operation was performed, except when a hysterectomy was required. It differs from that employed by Parke then and also from all present methods in that there have been adopted the following devices and rules governing the procedure:

1. Various mechanical and technical means to (*a*) accentuate the high-low principle, (*b*) shorten all incisions.

2. A method of closing the uterus and all serous surfaces without any exposed sutures or knots.

3. A principle of selection of cases, that while not strictly technical is yet a means of insuring better healing. The principle of selection is that which Lawrence advocated in 1915, *viz.*, (*a*) absence of repeated vaginal examinations; (*b*) absence of one vaginal examination unless the technic of the examiner is known to him to be satisfactory (in his own service, rectal examinations are required, vaginals prohibited, unless the first assistant performs them); (*c*) unruptured or recently ruptured membranes; (*d*) absence of any operative effort to effect delivery.

4. Changes in postoperative handling involving: (*a*) combating acidosis, routinely and immediately; (*b*) combating anemia, when present, by transfusion, preferably of uncitrated blood; (*c*) early feeding; (*d*) bed for twenty-one days to avoid disturbance in involution.

Lawrence then gives his personal technic in detail followed by a list of its advantages and disadvantages.

Lyle [35] reported six classical cesarean sections on the same patient. A woman of 29 had a history of rickets in early childhood, was of stunted growth, and her true conjugate diameter was less than 3 inches (7.5 cm.). Although the patient had already had six cesarean sections, she appeared well. At the last operation the uterine wall appeared strong and healthy. A male child was delivered alive. The method or procedure was similar in all cases. The operation was not performed until the patient had been one or more hours in labor. A mesial incision through the body of the uterus and the uterine wound was united by two layers of chromic catgut, the first layer being interrupted through the whole thickness of the uterus, and the second continuous through the peritoneum over the incision.

Maclean [36] related the history of a 30-year-old primigravida in labor two days. Forceps were unsuccessfully applied twice. The pelvis was flat. Cesarean section was performed forty-four and one-half hours after the onset of labor. The uterus was slow to contract. A living child with exaggerated cephalic molding was delivered. At first the patient improved in general appearance, but about one hour after the operation the uterus relaxed, dilated acutely, and a profuse postpartum hemorrhage occurred, drenching the bed and causing almost instantaneous death.

Shaw [37] wrote about the case of a woman with a flattened pelvis, with a diagonal conjugate of 3½ inches (8.75 cm.), and who gave a history of six previous cesarean sections. No difficulty with the previous operations, and this seventh pregnancy advanced quite normally to full time. Labor pains commenced a few days before the calculated date, the patient had severe uterine contractions for three hours before cesarean section could be performed, but the site of the uterine scar was thick and strong, showing no signs of stretching. The operation was uncomplicated, with a living child.

Thomas [38] described four cesarean sections on one patient as follows:

1st...labor, May, 1918.....baby 8¼ pounds
2nd...labor, May, 1919.....baby 9½ pounds
3rd...labor, Dec. 4, 1920.....baby 8½ pounds

The omentum was found densely adherent to the parietal peritoneum and anterior uterine wall. Upon opening the uterine cavity the edge of the placenta protruded through the open wound, apparently having been implanted over the uterine scar.

4th...labor, Nov. 6, 1921.....small baby

Many adhesions were found, involving the peritoneum, omentum, intestine and anterior surface of the uterus. At incision of the uterus a large portion of placenta protruded and it was evident that this organ was implanted upon the old scar. The uterine wall at this point was abnormally thin. The patient was sterilized. "Knowledge of the implantation of the placenta would greatly strengthen our position in regard to the treatment of cesareanized women."

Johnstone [39] gave the method of suture which he has adopted in over 80 cases of cesarean section; while differing from that in general use, it has at least the merit of being simple and rapid.

Three tiers of continuous suture are used, as more perfect apposition can be obtained in this way than by the use of interrupted sutures, and there is less risk of the formation of gaps in the line through retraction of the muscle between the points of suture. The first layer passes through the endometrium and holds its cut edges firmly together so as to prevent the intrusion of blood-clot between them with the risk of the subsequent formation of pits along the line of union. Objection to the passage of sutures through the endometrium is based on false analogy. The Lembert method of suture is indicated when the mucous membrane to be dealt with is constantly bathed by infective material, as in the case of the intestine, but may be discarded when dealing with a sterile mucous membrane such as that of the uterus. The second tier unites the thickness of the uterine muscle, and the third closes the peritoneum. The blanket stitch is preferred to the simple continuous one. Either Luken's or Merson's plain iodized catgut is used.

In all patients operated upon a second time the scar of the first section was practically indistinguishable from the surrounding uterine wall.

Holland,[40] writing as late as 1921, in discussing suture material used in the classical cesarean section considered that silk-worm gut was the best material, silk the next best and catgut most unsuitable.

Rice,[41] in a paper entitled "An Analysis of the Results in 130 Pregnancies Subsequent to Cesarean Section in 96 Patients," gave the following summary:

"A study of 96 patients with 133 pregnancies following cesarean section disclosed that 76 patients had 92 repeated sections, five of these were performed in other hospitals (other than the Manhattan Maternity and Obstetrical Service of the third division at Bellevue Hospital). Twenty patients were delivered vaginally at term in thirty pregnancies, one had two deliveries and one had six deliveries. Twenty-two of the primary sections were performed in other hospitals. Two patients had premature deliveries besides repeated sections. Seven had a spontaneous miscarriage. Two had induced abortions."

Findings at Operation of Repeated Sections (Rice)

Findings	*Number of Cases*
Moderate adhesions	10
Dense adhesions	8
Adhesive bands	4
Entire anterior wall of uterus adherent to parietal peritoneum	2
Ventral hernia. Mesentery and omental adhesions to peritoneum	1
Dense adhesions interfering with operation	1
Scar thin at upper angle	3

His conclusions were:

The number of cesarean sections could be greatly reduced by more frequent observation during pregnancy, and the use of trial labor in doubtful cases of moderately contracted pelves.

When cesarean section becomes necessary for delivery, the risks in future pregnancies are greatly lessened if the operation is properly performed.

In subsequent pregnancies when we may expect firm union in the uterine wall, a repeated cesarean section should not be performed without definite indication.

If repeated section is decided upon as the method of delivery, it should always be performed before the end of pregnancy.

Harris and Brown's [42] paper is based upon the bacteriologic study of the uterine contents obtained at 50 cesarean sections. In 19 elective sections performed at an appointed time at the end of pregnancy and before the rupture of the membranes, the uterus was uniformly sterile. The same applies to 6 cases in which the classical section was performed within four hours after the onset of labor.

In 5 patients in whom classical section was performed six or more hours after the onset of labor, bacteria could always be demonstrated in the lower uterine segment and there were streptococci in 3 of the cases. Similar results were obtained in 13 low cervical and 6 radical sections, and the uterine contents were sterile only in the 3 cases in which the operation was performed within a few hours after the onset of labor.

Harris and Brown believe that these bacteriologic findings clearly show why the conservative section is safe only when performed at the time of election.

While vaginal examinations and premature rupture of the membranes undoubtedly increase the likelihood of bacterial invasion of the uterus, the absence of these factors in no way insures a sterile uterus. Elevation of the temperature, likewise, is a valuable sign of intrapartum infection, but a normal temperature cannot be accepted as evidence that ascending infection has not already occurred.

Whether the presence of bacteria in the uterine cavity is due to the upward extension of bacteria already in the vagina or to an ascending infection from the vulva cannot be determined until comprehensive studies of the bacterial flora of the vagina have shown whether the occurrence of auto-infection is possible or not.

MORTALITY IN CESAREAN SECTION

Burnell,[43] in a series of 100 cesarean sections performed at the Long Island College Hospital, Brooklyn, reported a maternal mortality of 3 per cent, from eclampsia, hemorrhage and pneumonia and a fetal mortality of 4 per cent, three of the infants being premature.

Gordin [44] said: "The most recent statistics collected by Newell of Boston, gives the mortality at from 2 to 4 per cent in cesarean operation." Williams of Johns Hopkins gives a gross mortality of about 5.5 per cent or a net mor-

tality attributable to the operation of about 4 per cent. McPherson of the New York Lying-In Hospital gives a 1 to 2 per cent mortality in selected cases. Polak of Brooklyn in a report of 2000 cases of cesarean section collected from many clinics in North America, including Johns Hopkins, University of Pennsylvania, Sloan Maternity, New York Lying-In, and Jefferson, reports 2.9 per cent mortality in clean cases during early stages of labor and 6.6 per cent mortality in cases which had been previously examined or handled before admission to hospitals and a mortality of 11.5 per cent in cases thought to be infected. He also reports 200 cases from the Long Island College Hospital with 3.3 per cent in clean cases, 14 per cent in cases handled previous to admission to the hospital and a combined mortality of 6.1 per cent in all cases. Naturally when the operation is done by less experienced operators and in unfit cases, it carries a much higher mortality.

Kane [45] reviewed 100 cases of classical and 16 cases of low cervical cesarean section. In 100 cases of classical, 5 died (mortality 5 per cent), 4 from eclampsia and one from placenta prævia in a woman who had general carcinomatous metastases following amputation of both breasts for malignant disease. In the 16 low cervical cesareans performed on patients at least potentially infected, there was one death, giving a mortality of 6.25 per cent. This woman had been in labor ninety-six hours before admission, and high forceps had been attempted three times. Her temperature was 103° F. and her pulse 140 when admitted. She died of septicemia which was undoubtedly present before admission to the hospital on the fourth day. The autopsy showed the uterus to be almost entirely necrotic. The most interesting point in view of the claims in favor of the low cervical cesarean section was that there was a collection of pus between the bladder and the lower uterine segment which was kept out of the peritoneal cavity by the transverse line of Lembert sutures.

Holland [46] reported 3314 cesarean sections performed throughout Great Britain from the year 1911 to 1920 in which the average mortality was 4 per cent, with a mortality of only 1.6 per cent in the early uncontaminated cases, but 27 per cent in the late cases or in those in which delivery had been attempted.

Asa B. Davis [47] reported 28 extraperitoneal cesarean sections in presumably infected and mismanaged cases of prolonged labor with 2 deaths (7.1 per cent). One woman died the second day of general peritonitis. There was serosanguineous fluid in the peritoneal cavity and cultures showed hemolytic streptococci. The other death was due to pneumonia plus labor.

King [48] reported 117 abdominal cesarean sections at the Charity Hospital of New Orleans (excluding the Porro cases in which there were 12 deaths from peritonitis and 2 from sepsis). All the patients had vaginal examinations or attempts at delivery before operation. Mortality 12.0 per cent.

Lewis [49] reported a mortality of 10.1 per cent in 158 cases at the Cook County Hospital in Chicago with a corrected death rate of 9.4 per cent.

Krause [50] reported 148 suprasymphyseal cesarean sections with 5 deaths (3.3 per cent). In 2 cases peritonitis was the cause, and in another the probable cause. Two patients died before or during operation under lumbar anesthesia.

Warren [51] reported 106 cesarean sections with 12 deaths (11.3 per cent), ruptured uterus, 2; previous attempts at delivery, 1; impossible delivery of impacted breech, 1; hemorrhage from placenta praevia, 1; eclampsia (never regained consciousness after the first convulsion), 3; pulmonary embolism, 2; acute sepsis not known before section, 1; ileus, 1.

Baumm [52] stated that since October 31, 1922, 133 cases of suprasymphyseal delivery occurred in his clinic in a total of 7018 deliveries. This showed a frequency of operation of 1.9 per cent. Of 133 mothers 2 died, showing a mortality of 1.5 per cent. A previous series showed a mortality of 2.4 per cent. Fifty-two were not clean cases; the two deaths were from this group—one died of air embolism on the table, and the other of infection.

Lyon [53] reported 20 cesareans with 3 deaths (15 per cent), as follows: (1) Toxemia, eclampsia, acute suppression of urine; (2) peritonitis; (3) peritonitis, septicemia, positive blood culture.

Broich [54] discussed his subject under main headings, each of them a major symptom often used as an indication for cesarean section:

Internal Diseases.—*Cardiacs.*—Six patients delivered by abdominal section—5 died. Autopsy in 5 cases revealed mitral stenosis which in 2 cases was accompanied by stenosis of the aorta. In one patient in whom gonorrheal arthritis and endocarditis had been diagnosed, autopsy was refused. All the children remained alive.

On account of diseased internal organs, 13 vaginal sections were performed, 2 mothers died, one due to diabetic coma, the other due to an infection. Of the 10 viable children 2 died, one from asphyxia and one from a rent in the tentorium.

Eclampsia.—Eight women were treated by means of abdominal and 18 by means of vaginal cesarean section. All women recovered. All children extracted by abdominal section remained alive. Of the 14 remaining viable ones, one died of cerebral hemorrhage.

Placenta Prævia.—Eighty-seven were delivered by vaginal section and 13 by abdominal. Of the 87 vaginal cases, 3 died (3.4 per cent), one from hemorrhage, and one from infection. Of the 46 viable children 8 died (17.4 per cent). Of the 13 abdominal deliveries Broich lost one patient who was admitted in a hopeless condition. One child died of aspiration pneumonia.

Contracted Pelvis.—One hundred and forty-eight cases of contracted pelvis were treated by section. Three of them had previously been delivered by cesarean section. Of the 116 transperitoneal deliveries 3 women died: 2 of peritonitis; the third woman died on the eighth day after delivery from suppuration of the frontal sinus. Autopsy showed nothing abnormal with the pelvic and abdominal organs.

Extraperitoneal section was performed in 9 cases. Liquor amnii had been discharged for a period of nineteen to thirty-six hours. Mortality 0. Among the 23 repeated deliveries by section, 16 were second and 5 third operations. Two women died on the sixth and tenth days respectively as the abdominal sutures did not hold. One was a second and one was a third delivery by

section. Of 146 viable children (2 malformations), 4 died, one from asphyxia (prolapse of the cord), one from pneumonia and 2 were premature deliveries.

Breech Presentation.—Eight abdominal sections, large-child breech presentation in elderly primiparæ. Mortality 0.

Premature Rupture of Amniotic Sac; Primary Weakness of Labor Pains.—Vaginal cesarean sections, 15 (10 vertex, 4 transverse, 1 breech). Mothers all survived. Of 10 viable children one succumbed to asphyxia. One abdominal delivery in a primipara aged 38, membranes ruptured fifteen hours. She died of peritonitis on the fourth day. The child died of asphyxia.

Rice,[55] in an analysis of 133 pregnancies subsequent to cesarean sections in 96 patients, gave the following mortality:

Fetal Mortality.—In vaginal deliveries following section, one stillbirth in second stage, four and one-half hours.

In secondary sections 3 deaths (3.4 per cent):

1. Ruptured uterus
2. Prematurity
3. Prolonged labor

Maternal Mortality.—Three deaths out of 87 cases (3.4 per cent):

1. Ruptured uterus
2. Ruptured wound of abdominal wall
3. Pneumonia and empyema, death, one month after section

Montgomery,[56] in a paper entitled "Morbidity and Mortality of Cesarean Section," audited the cesarean sections performed in the wards of the Jefferson Medical College Hospital on patients admitted from September, 1925, to September, 1926.

There were 25 sections performed by various operators, all of the classical type, under ether anesthesia. There were 4 maternal deaths (16 per cent). Two died from sepsis, one from peritonitis, one from violent hemorrhage of placenta prævia. Twenty-six infants were delivered, 3 were born dead (11.9 per cent), and 3 died after delivery (11.9 per cent), a total mortality of 23.8 per cent. The 3 stillbirths occurred in cases of antepartum bleeding. Of the 3 infants who died after delivery one was premature, eight and one-half months in a case of placenta prævia, the second was luetic and the third not viable.

THE UTERINE SCAR AND RUPTURE OF THE UTERUS AFTER CESAREAN SECTION

Gamble [57] presented a detailed study based upon 63 pregnancies occurring in 51 women who had previously been subjected to cesarean section. Fifty-five of these pregnancies followed a single cesarean section, while in 8 there were two operations. A second or third cesarean section was done in 45 cases.

Vaginal delivery occurred in 17 cases. Rupture of the old cesarean scar occurred in one case.

Suggested Causes of Rupture.—1. *Excessive Distention of the Uterus.*—In the cases of rupture reported by Woyer, Couvelaire, and Scheffzek, the presence of hydramnion or multiple pregnancy had subjected the uterus to abnormal distention, which was assumed by these authors to have been a predisposing factor. On the other hand, Gilles, in 1916, reported the successful termination of a twin pregnancy without rupture of the uterus in spite of two previous cesarean sections. The combined weight of the two children was 4950 Gm.

2. *Forcible Intra-uterine Manipulations.*—Version and extraction, the use of hydrostatic bags, uterine tampons, etc., have been mentioned as possible causes of rupture, although it is only in cases of marked thinning of the scar that such factors are of any importance.

3. *Water-Wedge Theory.*—Spalding, in attempting to explain the rupture of the scar in a certain percentage of cases, advanced the theory that a small water-wedge formed by the amniotic sac may serve to dilate the thinned-out scar in exactly the same way that the bag of waters brings about dilatation of the cervix in normal labor.

In 1910, Mason and Williams studied the resistance of the cesarean scar experimentally. They subjected a number of pregnant animals to cesarean section and sometime later removed the uterus for investigation. They attached weights to a strip of muscle containing the scar and increased them until rupture occurred, when it was found that it took place through the sound muscle and not through the scar itself. Their experiments gave such uniform results that they drew the conclusion that a firmly united scar is even stronger than the intact uterine muscle and should easily be able to withstand any strain which the latter is capable of bearing. Moreover, the case reported by Harrar demonstrated that the normal muscle tissue may yield before the cicatrix, although the myometrium in that instance was regarded as having become devitalized. An anatomical study of the well-healed scar shows no reason why it should rupture before the surrounding muscle; it is probable that the statement of Mason and Williams holds true for a "firmly united scar." In the thin poorly healed wound, on the other hand, there can be little doubt that the rupture occurs directly through the scar and not through the adjacent tissue.

As Lane and Couvelaire have pointed out, the first step in the mechanical healing of the uterine scar is the deposition of fibrin between the edges of the wound, which acts as a framework for the ingrowing tissue which will eventually determine the character of the cicatrix. In spite of the constant contraction and relaxation of the uterus, if infection is absent, and the sutures have been so laid that the edges of the incision remain approximated, firm union will almost invariably result. On the other hand, if there is necrosis due to infection, or if the sutures tear through, leaving a gaping wound, there is an ingrowth of endometrium, which may involve almost the entire thickness of the wound. Such a scar, when seen in a subsequent pregnancy, is made up almost entirely of decidua and peritoneum, and its gross appearance in the

unopened distended uterus is characteristic. Instead of the vertical shallow depression seen in the more perfectly healed scars, it is represented by a glistening translucent band of tissue which bulges outward beyond the general surface; while, after the uterus has been emptied, hardened, and cut in cross section, the scar is marked by very deep depressions on both the outer and inner surfaces of the uterus. On microscopical examination it will be found that it is composed almost entirely of thickened and highly vascularized serosa overlying the decidua. There is an increase in the fibrous tissue and a definite decrease in the elastic fibers, while occasionally a few muscle-fibers may be present.

Under ideal conditions the muscle unites perfectly, and its fibers cross the site of the incision as if it had never been made. When, however, there has been no muscle union, the scar is made up solely of decidua and peritoneum. Most scars are marked by funnel-shaped depressions on the outer and inner surfaces of the uterus. The muscle-bundles are not much distended, the formation of fibrous tissue is much less than would be anticipated, and when it is increased, the elastic fibers are correspondingly diminished in number.

Gamble [57] gave the following conclusions:

1. The weak cesarean scar may be due to a single factor or to a combination of factors, the most important of which is infection.
2. An afebrile puerperium does not give an absolute assurance of perfect healing.
3. The perfection of technique in suturing the uterine incision will undoubtedly lessen the incidence of weak scars.
4. Chromic catgut, in our hands, has proved to be a satisfactory suture material.
5. The uterine wound should not be closed, if possible, until firm contraction of the musculature has occurred.
6. As a rule, fetal elements do not invade the uterine scar.

Schwarz and Paddock [58] in a beautifully illustrated article entitled "The Cesarean Scar," came to the following conclusions:

In the healing of the incision in the wall of the guinea-pig uterus, after abdominal section, they state that the edges of the wound are held together by the early proliferation of fibroblasts along with capillaries, not only along the line of incision, but also very definitely between the muscle-bundles adjacent to the line. A definite scar tissue develops and this can be clearly demonstrated in uteri from twelve to twenty-five days after the incision. In their cases of twelve days after incision this was quite considerable. In the later stages, for example in their case of ten weeks, the line of scar-tissue formation with its ramifications is so contracted that on histologic examination it is difficult to make out, and it assumes very definitely the normal pattern of an uninjured uterine wall. That muscle regeneration plays no conspicuous part in the final picture should be emphasized from the fact that the very laborious studies of Loeb and his coworkers show that mitotic figures are rarely found in the uterus of the guinea-pigs seven days after delivery and rarely after eleven days when the uterus is injured. This means, in the opinion of the authors, that muscle

regeneration, if it is to play a conspicuous part in the disappearance of the scars, must do it early. It is quite evident from their sections that this is not the case. Endometrial tissue is readily carried along the line of incision and readily implants itself on the peritoneal surface of the uterus. The frequency and extent to which this takes place is undoubtedly due to the marked abundance of endometrial tissue in these uteri. However, the actual peritoneal implantation of this tissue shows how readily and how easily this occurs. This, however, is further evidence of Sampson's implantation theory.

As regards the early healing of the human uterus after incision at cesarean section from the material that they were able to study, the authors would agree with Couvelaire that the deposition of a considerable band of fibrin between the cut muscle edges forms the basis from which healing takes place. That the line of defect in these cases where approximation has been good should be very small is illustrated in their cases by close approximation of the muscle edges. Fibroblastic proliferation, which was definitely evident in their first case, which can be considered as practically normal healing, indicates that the early process is similar to that in the guinea-pig. They felt that the absence of demonstrable scar over a considerable extent of a well-healed wall is due to the fact that the line of scar tissue is small to begin with, and secondly, because of its ramifications along the line of incision between the adjacent muscle-bundles. Therefore, as the scar contracts, it simulates more and more the normal pattern of the uterine wall and is not demonstrable on histologic examination.

They felt that this explanation of the shrinking of the scar as well as its many ramifications between the muscle-bundles add to its strength. They also think that sutures that are placed too tight, particularly the deepest row, will cause an increased amount of necrosis and will cut through more readily, leaving a gaping inner defect in the wound. On account of the low vitality of the tissue under such circumstances, filling of the defect by granulation tissue should take place only after a more prolonged period of time, and thus the much more rapidly proliferating endometrial tissue has an opportunity to enter and line the defect. It is obvious that the more extensive the cutting through of sutures is, the greater will be the amount of necrosis, and therefore the greater the defect. Infection can further increase the necrosis and thereby allow the sutures to cut through more readily.

They feel that in this way many cases of thin scars which are lined with endometrial tissue are readily explained. The reaction around the catgut sutures in their two clean human specimens, with the amount of necrosis around them, suggests that this material is by no means the best. In contrast to this, and in the absence of infection, there was little or no reaction about the silk sutures in the guinea-pig uterus.

They conclude that the most important thing in the technic of elective cesarean section is to obtain good wound approximation with a minimum amount of suturing, with as little tension on the sutures as possible. They feel that a single row of buried interrupted sutures, and an outer running suture after the method used by Williams, should give the best results.

Weber [59] felt that the pertinent factors in the formation of a weak scar were inclusion of decidua between the sutured muscle, placing the muscle sutures too far apart, incomplete closure of muscle layers, due to retraction of the muscle-fibers after being incised, hemorrhage and shock of operation, producing a lowered resistance to infection, and implantation of the placenta in the scar.

He summarized his article by stating that:

Rupture of the uterus in hysterotomized women is about 2 or 3 per cent, with a mortality of about 50 per cent. A septic puerperium, with a purulent vaginal discharge, is prima facie evidence of a resultant weak scar. All cesareanized patients should be hospitalized toward the latter months of pregnancy. One successful normal delivery may be followed at the succeeding pregnancy with rupture. If there is no maternal dystocia and no other contra-indication, the patient may be given a chance to be delivered normally.

He included a case report, the salient points of which were: The patient was delivered by a previous elective hysterotomy with no history of infection. Rupture occurred at the thirty-sixth week, shortly after the inauguration of the first stage of labor. The profound symptoms of shock and hemorrhage were observed and prompt improvement after the removal of the dead fetus and uterus.

Cameron [60] thought that adhesions within the abdomen were usually undesirable, but in some cases of repeated cesarean section their presence seemed advantageous, since they caused firm fusion between the uterine scar and the parietal peritoneum, thus diminishing the tendency to rupture. Despite various modifications in the method of closing the uterine wound, the danger of rupture in subsequent pregnancies still exists. Cameron has reached the following conclusions:

The gravity of this complication depends, to a great extent, on whether the uterus manages to expel its contents completely or not. (1) If there be only partial extension from the cavity, the uterus cannot retract effectively and death may rapidly ensue from hemorrhage. (2) On the other hand, if the contents are quickly ejected into the peritoneal cavity, and if rupture is unaccompanied by severe shock the patient may actually walk into the hospital and live for some days without operation. In such instances little blood is found in the belly cavity, and the empty uterus remains in a state of firm retraction. (3) In cases in which the uterine wound has been infected there is less loss of blood when rupture occurs, as the margins of the wound have never remained in apposition and the opposed surfaces are non-vascular.

Bailey [61] reported 2 cases of antepartum rupture of the uterus through a previous cesarean section scar. Both mothers recovered. One child was dead and the other failed to revive after removal.

Graham [62] reported the case of an elderly primigravida who had an obstructed labor due to pelvic contraction. Craniotomy was performed. She recovered. Another pregnancy was terminated with cesarean section. Good recovery. A little more than a year later another pregnancy was terminated by cesarean section with a living child. Two years later she was again preg-

nant and a third cesarean section was performed. When the abdomen was opened the uterus was found to be ruptured with the fetus and the placenta lying free in the abdominal cavity, the membranes were ruptured. Hysterectomy was performed with perfect recovery.

Kosmak [63] gave the details of a case of rupture; the reason given was short interval between the two pregnancies, the first having been terminated by cesarean section. The second one went to term and no suspicion of a ruptured uterus arose until the old scar was reopened. The child had died the day before the operation.

E. P. Davis,[64] in a paper entitled "The Uterus after Cesarean Section," stated that where silk had been used in sewing the uterine wound the danger of rupture was less, while it was thought that the ideal suture material would be silkworm gut.

While the choice of suture material is important, we know that in the classic operation the efficient and accurate closure of the uterine muscle is indispensable. While methods of operation may differ, this must be accomplished.

It is a general principle in surgery that rapid and complete union in wounds is not to be expected in patients whose general condition and power of resistance are greatly vitiated. This holds good in cesarean section, and the obstetrician may be called upon to effect delivery in cases where the general condition of the patient is so bad that it is unsafe to suture the uterus and allow it to remain. Five case reports with microscopic illustrations are given where the author had removed the uterus at the delivery following a previous cesarean section.

Heffernan [65] reported the case of a woman 38, who had had three previous cesarean sections. There were indications that rupture of the uterus had occurred a short time before operation. He advised performance of cesarean section on such a patient a few days before the estimated date of labor.

C. J. Kickham [66] reported a case of ruptured uterus in a previously cesareanized woman where the fetus remained intact within the membranes following rupture. He does not agree with the saying, "Once a cesarean always a cesarean," but he also thinks that it is usually safer to operate again, especially if the uterus is distended with fluid or a large fetus.

Strache [67] published a case report with the following conclusions: (1) Rupture in the scar is less common when the incision is made in the cervix than when made in the body of the uterus. (2) Rupture is caused, as he thinks, not by faulty suture but rather by infectious processes in the region of the wound. He warns against vaginal examinations and suggests rectal examinations in their place. (3) Rupture is the exception and not the rule, especially at the hands of a skilled surgeon. He quotes Döderlein, Guggisberg, Küstner, and Hussy on these various points and indicates that he is an adherent of their views.

Audebert [68] stated that the results of 38 histologic studies confirm the opinion which he had previously presented at the Congress of Lille in March, 1913, that is, the complete muscular regeneration at the level of the uterine

scar after cesarean section is possible, and furthermore they show the frequency of this muscular regeneration which was perfect 29 times in 38 cases, or 73 per cent; incomplete regeneration of the muscle, 3 times in 38 cases, or 11 per cent; while only 5 times in 38 cases, or 14 per cent, were fibrous scars found. Couvelaire, moreover, seems at present to admit the possibility of muscular regeneration. In concluding, Audebert feels, in a general way, that the uterine scar after cesarean section is histologically and physiologically good in the majority of cases, and this, despite the inevitable possibility of suppuration and infection. He was surprised to find good muscular repair in one of his personal cases, and in a number reported by Gamble. On the other hand, he has noticed that despite an afebrile puerperium and without the slightest suspicion of infection, muscular regeneration was absent or barely attempted. Under these conditions should we, as we did formerly, base our prognosis in regard to the uterine scar on the result of an afebrile or febrile puerperium? In his opinion, it is impossible to guarantee the condition of a postcesarean uterine scar. Moreover, we should insist on the extreme frequency of thinning at the level of the internal surface in the region of the cicatrix, the presence of which can only be ascertained by intra-uterine palpation. The clinician has no right to be positive in either case. We do not know whether or not the scar is firm or weak. What we do know is that in 73 per cent of the cases the scar is muscularly perfect. No matter what we do the risk of a uterine rupture in a future gestation will always exist, and let us not forget that at the present time rupture is found in about 6 per cent of the cases. For this reason he feels that the cesareanized patient should be followed closely and that repeated sections should be performed before the onset of labor.

Audebert and Fournier [69] reported a case of rupture of the uterine scar at the onset of the third labor in a woman who had had two previous cesarean sections. The rupture occurred while she was being taken to the hospital; she was seized with a severe pain in the hypogastric region during the journey. An operation was performed by Fournier. Abdominal incision. Numerous omental adhesions to the thinned out abdominal wall. Ruptured previous uterine scar on which the placenta was inserted. The placenta was pushed one side and a living child weighing 3600 Gm. was extracted. Subtotal hysterectomy followed. The mother was discharged from the hospital on the twenty-third day. The child died the thirteenth day after having lost 500 Gm. in weight.

Cerné [70] related the history of a secundipara who had a cesarean section for contracted pelvis. The puerperium had been complicated by high fever; the patient had left the hospital one week after the operation with a high temperature but had nevertheless recovered. Her second confinement was expected at the end of May, 1926. On May 13th, while splitting wood, she felt a violent pain in the abdomen which she compared to a tearing sensation in the abdomen. She had to lie down on the ground until she was carried to her bed. She was taken to the hospital where she was seen by the midwife in charge, who noted nothing abnormal. She was seen by Cerné twenty-two hours after the

accident. He made the diagnosis of ruptured uterus and operated. The fetal sac containing the fetus was delivered intact, as it was found in the abdominal cavity. The uterus was contracted; it was ruptured at the site of the previous cesarean scar where the placenta had its insertion. Subtotal hysterectomy was performed. The mother recovered and left the hospital on the twenty-fourth day.

Kerr, McIntyre and Hendry,[71] at a meeting of the Section of Obstetrics and Gynecology of the Royal Society of Medicine, on June 5th, 1924, contributed a conjoint paper on wounds of the gravid and non-gravid uterus—a study in uterine scars.

In discussing the question of scars following cesarean section, Kerr quoted the fact that, of patients who went into labor subsequent to this operation, the uterus ruptured in 4 per cent, and that the vast majority of scars following the classical operation were far from satisfactory. The reasons for the existence of this unsatisfactory state of affairs, when the operation was carried out through the contractile portion of the uterus, were given as follows: (1) The difficulty in securing complete asepsis; (2) the rapid degenerative changes occurring in the uterine muscle; (3) the irregular disposition of the sheets of muscle, making it impossible for the individual fibers to be accurately apposed; (4) the necessity imposed on the surgeon of using a ligature for hemostasis as well as to keep the surfaces in apposition; (5) the frequent situation of the placenta on the anterior wall (in some 40 per cent of cases), causing an unsatisfactory condition for the healing of the scar; (6) the liability of the ligatures to go through the decidua, and by pressure to cut through that layer, causing a fibrotic scar on the inner aspect of the uterus. He, therefore, advocated the use of the incision through the lower uterine segment. Some of the chief points in favor of this operation were that the wall of the uterus in this area was quite thin, the tissue much less vascular, and the surface of the wound could be brought more accurately together, thus preventing the formation of "blood pockets." This area was more passive, and less disturbed, than in the upper segment. The wound was completely covered with the bladder wall and the peritoneum, thus preventing any infection spreading to the abdomen. The likelihood of adhesions forming was much less. The wound was not put on a stretch in a subsequent pregnancy, and the strain, even in a subsequent labor, was considerably less than if the scar were in the upper part of the uterus. He had never met a case of rupture of the scar when the operation was performed in this way, although some such cases had been reported from France.

McIntyre presented a paper on the histologic studies of various uterine scars, and showed a series of microphotographs illustrating their histology. The first of these was a wound produced by a cervical dilator. The remaining slides were chiefly devoted to demonstrating the histology of scars resulting from cesarean section. All but one of these were taken from scars following the classical operation. Speaking generally, they showed that the scar consisted of a considerable proportion of fibrous tissue, but muscular continuity could be demonstrated in most cases, right across the line of incision. The

thickness of the wall in the line of the scar was diminished in nearly every case, but was increased in the immediate vicinity. This diminution in thickness varied considerably. In some cases the scar was dangerously thin. Another interesting point was shown in some cases, namely, isolated portions of the mucous membranes had been caught between the two surfaces of the incision, or possibly had migrated there. In some of the slides the cavity made by non-absorbable sutures was visible, and this fact had led McIntyre to invent a catgut having strands of silk embedded in it. However, he considered that it was too soon to make any statement as to the value of this new suture material.

Hendry discussed the uterine scar after conservative cesarean section, (1) when the incision was made in the active contractile portion of the uterus, (2) when the incision was made in the lower uterine segment. He dealt with the macroscopic findings in a number of "repeat" cesarean operations. In describing these cases it was remarkable how often dense adhesions occurred in cases where the classical operation had been performed, whereas in the incision through the lower uterine segment there was not a single case in which adhesions occurred in the region of the scar. He considered it a great advantage for the patient to be in labor if this technic was undertaken, as the lower uterine segment was then well formed, as well as a solution of the problem of unsatisfactory uterine scars due to cesarean section.

J. T. Williams,[72] in his publication entitled "Care of Pregnancy and Labor in Patients Previously Delivered by Cesarean Section," stated that his experience, both with the repeated cesarean section and with a series of 10 patients safely delivered one or more times by the natural passage after a previous cesarean section, has led him to believe that the maxim, "Once a cesarean always a cesarean," is unscientific and unjustified. The future of a cesareanized patient should be decided upon the merits of the individual case, guided by rules based upon clinical experience and experimental evidence.

In addition to the temporary indications above referred to, there is a distinct class of cases where cesarean section is performed in the absence of a distinct pelvic indication because, the patient having lost her first baby after a difficult operative delivery, usually a dry labor or primiparous breech, both the obstetrician and the patient desire to take no chances in the second labor. This indication may be unsound, but 3 of Williams' cases were of this class, where cesarean in the second pregnancy (performed by another obstetrician) was followed in the third by an easy normal labor.

The experimental work of Mason and Williams showed that in animals a perfectly healed scar would withstand any strain which could be borne by the muscle itself. J. Whitridge Williams, Losee, and others have demonstrated that in a perfectly healed cesarean scar regeneration of the muscle-fibers takes place and the appearance of the scar is histologically equal to that of the rest of the uterus, but each reported the occurrence of defective scars in which rupture had taken place.

Holland had collected 92 cases of ruptured cesarean scars from the literature. Of these, 36 ruptured during pregnancy, and 48 during labor (the rest

not stated). The same writer collected reports of 1605 cesareanized women from twenty-five British clinics. Of these, 1103 were followed up, among whom 487 became pregnant again. Delivery by the natural passages occurred in 78; rupture of the scar in 18; repeated cesarean section in 352; miscarriage in 47; and the remainder were undelivered at the time of the report. In other words, he found that rupture of the scar in subsequent pregnancies occurred in 4 per cent, but that nearly as many ruptures took place during pregnancy as during labor.

The mortality of cesarean section is variously estimated by different writers, ranging from 2 to 4 per cent, according to Newell, to 10 per cent according to J. W. Williams. If the incidence of rupture of the scar is lower than the mortality of cesarean section, it would seem logical to allow these patients, where there is no other indication for cesarean, to go into labor and be delivered by the natural passages. It is of course important, however, that all such patients should be kept under the closest observation during pregnancy and delivered in a well-equipped hospital under the personal attendance of an obstetrician qualified to do abdominal surgery.

J. T. Williams' experience has confirmed this opinion, he having performed 16 repeated cesarean sections, in only one of which was any considerable thinning of the scar found, and in that instance the thin place corresponded to an area alongside the old scar where an interstitial fibroid 1½ inch in diameter had been removed at the previous cesarean.

On the other hand, where there is a permanent indication for cesarean section persisting in subsequent pregnancies, such as contracted or deformed pelvis, there is no justification for allowing the patient to go into labor, but elective cesarean section should be the method of choice.

J. T. Williams delivered 10 patients (two of them more than once) by the natural passages, following cesarean section, with a normal result. An abstract of these cases is given.

Guérin-Valmale and Gaudière [73] gave a brief description of a uterus removed from a young woman at her second pregnancy, on the insistence of her husband. The first child had been delivered by cesarean section and lived, also the child removed at the present operation.

Examination of the uterus disclosed the uterine wall to be perfectly reconstructed, anatomically, at the point of the first cesarean section. "It is a true restitutio ad integrum."

P. Keller [74] reported 2 cases. He pointed out that these cases indicate that rupture may occur not only in the cesarean section scar but also at the point of adhesions in other parts of the uterus, *i.e.*, adhesions to the peritoneum. He says that even though there is only a low percentage of ruptures in later pregnancies (about 4 per cent), this danger must still be given serious consideration, especially since there is an ever growing list of indications for cesarean section.

Max Wetterwald [75] reviewed the literature, and concluded his article as follows: On the basis of his study, it is evident that the danger of rupture of the uterus is very slight after cervical section. As factors leading to rupture,

the following may be considered: Faulty technic of suture, infection of the wound during confinement, lengthening of incision, use of intra-uterine interventions for the purpose of hastening delivery (*i.e.*, version) and especially the occurrence of placenta prævia in the next pregnancy. Surgeons should be very careful in their use of hypophysis extracts. Rapid succession of pregnancies is hardly to be looked upon as a cause of rupture.

In all cases of cervical cesarean section it is imperative that women who have once been delivered by this method should place themselves under the regular care of a physician during the next pregnancy and at the time of delivery be cared for in a clinic.

Asa B. Davis,[76] in an article entitled "The Ruptured Uterus," stated that, in 1909, Ralph Waldo Lobenstine read a paper entitled "Rupture of the Uterus during Labor." His study was based on the records of the New York Lying-In Hospital from 1890 to 1909, and the paper was published in the *Transactions of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons,* 1909, and also in the *Bulletin of the Lying-In Hospital,* Volume 6, No. 2.

Davis reported 184 cases of ruptured uterus in the service of the New York Lying-In Hospital. He included the 78 cases found in Lobenstine's article, the remaining 106 having occurred since 1909. The incidence of rupture of the uterus was 1 in 810 cases. In these 184 cases there were 88 complete ruptures. Included in the total of 88 complete ruptures were 24 which occurred through former cesarean scars. While rupture through the cesarean scar in a subsequent pregnancy is a serious accident, Davis finds that the prognosis for the mother is far better than in other cases of complete rupture. Of the 24 mothers included in this group, 21 recovered. For the baby the prognosis is bad, 5 out of 24 were saved. In 4 instances subtotal hysterectomy was done, 2 of the 3 maternal deaths following this operation. He further stated: "In many of these cases we find considerable hemorrhage and well marked shock, while in others comparatively little bleeding occurs, separation having taken place, the wound is plugged by the placenta. In some there had only been slight union of the muscle following the previous cesarean, and the rent occurs through scar tissue which does not bleed seriously." He believes that the best treatment for these cases is to freshen the edges and resuture the wound, ending the operation as quickly as possible and postponing further operative procedure, until some future time when the patient will probably be in better condition.

He feels that any patient who has been subjected to cesarean section should be in the hospital a week or ten days before expected full term in a subsequent pregnancy, and where it is known that a patient must again be delivered by this operation, it should be done before the onset of labor.

Davis states that in the rupture of the cesarean scar we are dealing with a very different proposition from the conditions which are found in the ordinary complete rupture. These wounds are not infected; they are limited to the cesarean scars, and the tissues about them have not been unduly stretched and contused.

Maxwell [77] reported a case of rupture of the scar following low cesarean section. Mrs. A. V., a Greek, aged 27, a multipara, was seen in the outpatient department of the University of California Obstetrical Service in the seventh month of her second pregnancy. She had been delivered of her first child seventeen months previously by cervical section, by an experienced obstetrician, after some hours of labor. A cephalopelvic disproportion was the reason for section. Her convalescence was uneventful, and she was discharged after thirteen days.

The pelvic measurements, physical examination and pregnancy were normal, but the patient was advised to report to the hospital with the onset of labor pains. In general, it has been the policy of the department not to permit a patient to attempt natural labor after a previous cesarean section.

Labor began late at night, just at term, but the patient did not enter the hospital until four hours had elapsed, at which time the pains were coming every three minutes and were non-expulsive in character. The membranes had not ruptured, and there was no hemorrhagic discharge. No rectal nor vaginal examination was made, and she was immediately prepared for a laparotomy. Within an hour the patient was catheterized and anesthetized; the old scar extending from the umbilicus to the symphysis was excised and the abdominal cavity entered. A few omental adhesions to the former midline incision were readily freed and the lower portion of the uterus presented. Much to her surprise, a fair-sized hematoma about 3 inches (7.6 cm.) in diameter was found under the peritoneum at the vesico-uterine junction. The peritoneum was excised at this point, and the blood-clot removed, which showed that the bleeding was coming from a rent in the uterus just behind the bladder. The rupture was about 2 inches (5 cm.) long, running in a longitudinal direction, and a finger was passed through the separation directly into the lower uterine cavity. There was no difficulty in separating the bladder off the uterus, enlarging the incision through the rupture and delivering the child. An 8-pound (3.6 Kg.) baby girl was delivered in good condition. The mother made a rapid recovery, and was discharged on the fourteenth day.

Calvanico [78] reported the case of a woman, 37 years old, delivered by a previous cesarean section. On incising for the second operation, on the anterior face of the uterus there was seen a protruding portion corresponding to the cicatrix of the previous operation. The second incision skirted the edge of this protrusion. The wall was thin, like connective tissue, and corresponded to the implantation of the placenta. In detaching the placenta it remained adherent to the cicatrix. The cicatricial tract was excised. Histological examination of the cicatrix gave the following: In some points the elements of the musculature of the uterus resembled muscular fibers of gestation; that is, they were hypertrophic in the highest degree, hyperplastic to a certain degree.

In the tract corresponding to the cicatrix there appeared a space 2 to 3 cm. wide on the myometrial walls, and then a narrow stratum 1 Mm. wide. This thread represented a very thin bridge between the two walls of myometrium. It was made up largely of connective-tissue fibers with a few smooth muscular elements. The external surface was covered by a delicate thin stratum of

peritoneum made up of endothelium and by a thin connective-tissue stratum which was confused with the cicatricial one of the cesarean wound. Numerous blood-vessels ran in the thickness of this little tract.

On the uterine surface, where it does not increase gradually but slips up abruptly from the thin tract to the walls of myometrium on both sides, placental villi were implanted. In this small tract villi invaded the connective tissue which was reduced to ½ Mm., and the tissue was almost entirely constituted of subserous connective tissue and that not very abundant.

This histological examination confirms the diminished resistance of the uterine cicatrix after cesarean section, especially when, as in this case, recovery was disturbed by suppuration.

CESAREAN SECTION UNDER SPINAL ANESTHESIA

Astley [79] stated that the situation with the victims of toxemia is briefly that, during the progress of pregnancy, either solely because of pregnancy or because of antecedent pathology plus pregnancy, a condition develops which jeopardizes the life of the mother, and carries with it, therefore, at least an equal hazard to the life of the child.

In considering the treatment of the mother the therapeutic situation may be epitomized as follows: If reduction of metabolic activity by rest and by limitation of diet, and the increase of elimination of waste products by proper measures, do not bring relief, the question of termination of pregnancy is brought up. If termination of pregnancy is decided upon, the details of each step necessary to delivery must be considered and evaluated; and if the patient is seen in the crisis of eclampsia, the same consideration is no less necessary. He considers it logical to relieve the mother of the strain of the continuation of pregnancy, if this can be done without adding factors of risk greater than those already being faced.

Possible maternal dangers in a rapid delivery are:

1. Shock from traumatism, if delivery be attempted by the natural route where the parts, either because of the period of pregnancy, the age of the patient, or local conditions are unyielding.
2. Infection of unavoidably traumatized tissues in the presence of lowered general resistance.
3. The hazards of the anesthetic in the presence of kidney and liver incompetency, and of cardiovascular strain incident to high blood-pressure.

There is the same situation in regard to the child:

1. The child shares with the mother in the toxemia and enters life with that certain, though unmeasurable, handicap.
2. Rapid delivery entails more physical risk than one of deliberation.
3. Prematurity will lessen the resistance to both the toxemia and the physical strain of delivery.

The anesthetic used in the delivery of the mother may be sufficient to turn

the tide against the child, where resistance would have been sufficient otherwise, by making resuscitation difficult.

Astley believes, then, that spinal anesthesia is the method of choice, to be used in the interest of the mother, in certain cases of toxemia of pregnancy because:

1 It allows of the most rapid emptying of the uterus, that is, by cesarean section, with the minimum shock to the patient, because its action is that of a nerve-block with complete muscle relaxation of the abdominal wall, permitting most expeditious work.

2. At the same time it gives us the benefit to be derived from lumbar puncture in the lowering of cerebrospinal pressure, and from the lowering of blood-pressure which its use entails.

3. It adds no element of hepatic toxemia or renal irritation, and reduces blood-pressure instead of elevating it as oxygen and nitrous oxid may.

In the interest of the fetus, spinal anesthesia is especially valuable where, because of marked toxemia or because of prematurity, fetal resistance is at a low point. The reason for this is: It adds nothing to the blood which may interfere with resuscitation, or with the functioning of any other already impaired vital process. Its use, therefore, is particularly indicated where even more than average importance is attached to the life of the child, as in elderly primiparæ who have had renal impairment antedating pregnancy, and where conception, therefore, may not be allowed to occur again.

Thirteen case reports are given. Twelve patients, all primiparæ, one twice operated upon, giving thirteen operations. In the series, 2 mothers died, one from hemorrhagic nephritis, and the other from pneumonia. Two children died, one at 6 months, surviving three days, and one at 6¾ months, surviving two days.

The method of spinal anesthesia used was that employed at the Samaritan Hospital, Philadelphia, in the surgical clinic of W. W. Babcock.

H. Krause [80] felt that, with a few exceptions, cesarean section, as well as all other gynecological operations, should be done under tropacocain lumbar anesthesia. Only in cases in which, on account of the form of the spinal column or for other reasons, lumbar anesthesia could not be carried out, chloroform ether narcosis was used. Lumbar anesthesia was accomplished in the following manner throughout the whole period of time: In the lateral position puncture was made in the lumbar sac between the second and third or between the fourth and fifth lumbar vertebræ. After a few c.c. of clear liquor have flowed out, 8 c.c. of liquor are drawn out by suction, combined with 2 c.c. of a 5 per cent solution of isotonic tropacocain solution (Merck) already contained in the syringe, and this is very slowly and carefully injected. Before the patient is placed on the operating table she is allowed to lie in the dorsal position for about five to ten minutes. Previous to February, 1910, stovain was used in place of tropacocain. Formerly a dose of 0.0004 scopolamin and 0.01 morphin was given before inducing lumbar anesthesia with tropaco-

cain. But now for some time scopolamin morphin has been omitted in cesarean section out of consideration for the child.

Unfortunately, this clinic experienced 2 deaths in connection with lumbar anesthesia, the only two which ever occurred in this form of anesthesia, and it is especially noteworthy that they both occurred in connection with cesarean section. A third case might also be added to these. This involved grave paralysis after lumbar anesthesia in the case of a woman on whom cesarean section was to be performed; the woman, it is true, escaped with her life, but the child was fatally injured.

It is especially noteworthy that in all three cases the patients were unusually small women (1.24 M., 1.40 M. and 1.39 M. tall), so that one immediately thinks of an overdosage, all the more so since lumbar anesthesia has been given to several thousand women in the same manner in gynecological operations without any injury at all. Vogt in a recent article described a similar case, and thought that the preparation of the patient with scopolamin morphin should be blamed for death in lumbar anesthesia. Vjaschske also described a case of death in cesarean section under lumbar anesthesia but gave no reason or even conjecture concerning the cause. In one of the patients autopsy revealed thymus persistens, but Krause still believes that it can be assumed that in all three individuals it was a matter of constitutional inferiority, accentuated by lowered resistance caused by pregnancy. In any case, three casualties should serve as a warning and he states that in his clinic very small, especially hunchbacked patients on whom cesarean section is to be performed, are not given lumbar anesthesia any longer. Likewise, the previous dosage of scopolamin morphin, before lumbar anesthesia, has been omitted for some time in cesarean sections, since it has been found that in a cesarean section with apparently normal course, a child showed symptoms of scopolamin poisoning and died on the third day with cyanosis and cramps. The omission of scopolamin morphin before operation results in no disadvantages.

Boursier, Nard and Rivière [81] reported the case of a primipara, aged 24, with double congenital luxation of the hip, complex and atypical imperfections of the pelvis, marked above all by a contraction of the anteroposterior diameter and considerable projection of the lumbar vertebræ. Classical cesarean section at term after sixteen hours of labor was performed. Lumbar puncture was difficult on account of the excessive lordosis but was finally accomplished between the eleventh and twelfth dorsal vertebræ. They were struck by the fact that the operation was bloodless even without the injection of ergotin. Both mother and child recovered. The fetus, although the membranes were intact, and there had been no tendency to engagement, presented a very marked depression of the left frontoparietal region, due to the pressure of the lumbar column. Although extracted rapidly, the child was very difficult to resuscitate and was in a state of asphyxia pallida. This could hardly have been caused by the type of anesthesia used.

Brindeau [82] recently wrote that spinal anesthesia is little employed in obstetrics, as general anesthesias are very well borne by the pregnant woman.

However, this mode of anesthesia can render great service, principally in certain cases of obstetrical surgery.

It was Doleris who first thoroughly studied spinal anesthesia for the woman in labor, but his investigations were not followed. Only such authors as Audebert, De Rouville and Delmas have praised the advantages of this procedure. Brindeau had carried out 232 spinal anesthesias on pregnant women. This mode of anesthesia presents certain characteristics which are of note from the point of view of obstetrical physiology. *Its effect is to increase uterine contraction and retraction while it paralyzes the whole non-contractile zone of the cervicovulvoperineal passage.* These physiological properties are of the greatest value in the cesarean operation; they explain the almost complete absence of hemorrhage.

Brindeau has performed 102 cesareans under spinal anesthesia. In 71 cases the operation was suprasymphyseal and in 31 cases classic. In the 102 attempts, he was forced to abandon it 6 times, on account of the impossibility of making the lumbar puncture. In one case the anesthesia had no effect and in 8 cases it was necessary to give some whiffs of ether. In all the other cases the anesthesia was perfect, and the operation proceeded in ideal fashion. It is necessary to state, however, that spinal anesthesia is not without danger for the pregnant woman, as there were 2 deaths in 232 cases; one of them was suffering from generalized edema and pulmonary emphysema, but the other seemed absolutely healthy. Complications were exceptional, little or no vomiting, headaches rare, one case of retention of urine lasting a month, one slight and transient paralysis of the sixth pair of nerves. The lumbar puncture was always used, followed by injection of 6 to 7 Cgm. of a 10 per cent solution of stovain. At present he prefers a preparation in which 8 to 10 Cgm. of powdered novocain are dissolved in the spinal fluid of the patient.

Brindeau concludes, from his experience, that spinal anesthesia renders the cesarean operation very much easier, particularly when one selects the suprasymphyseal procedure.

Lantuéjoul [83] stated that the history of spinal anesthesia in general, and its application to obstetrics in particular, may be read in the thesis of Malarch (Paris, 1901). He discussed the advantages and disadvantages of the method as applied to purely obstetrical manipulations, such as the application of forceps, version and extraction, and the repair of birth injuries. The technic and the use of various drugs from cocain to stovain were discussed. He repeated Brindeau's statement at the Congress of Geneva: "The results are surprising, the cervix and the vagina are flaccid and as paralyzed, and despite this, the uterine contractions are not arrested." Among his case reports he included four cesarean sections of the classical type, for contracted pelvis. Each time it was noted by Brindeau, in whose service the operations were performed, that the uterus contracted vigorously, more so than under general anesthesia. In one case the uterine wall was so thick that it was impossible to take in the two sides of the incision in one bite of the needle. In another case the delivery of the placenta through the incision was spontaneous. The infants cried immediately, and the convalescence was perfect in all the mothers.

Brindeau [84] at the March 9, 1925, meeting of the Société d'Obstétrique et de Gynécologie de Paris, reported his first death under spinal anesthesia, his one hundred and ninety-fifth case of that type of anesthesia. This was a low cervical cesarean section performed on a primipara 27 years old, in labor for fifty hours. The child was very large (5250 Gm.), the head was at the superior strait and the dilatation was slight. The woman was obese and considerably edematous. The lumbar puncture was difficult, but successfully accomplished after five or six attempts. Six or 7 Cgm. of stovain was injected. After one minute the parturient was placed in the horizontal position and then in the Trendelenburg. As the operator was about to make the incision she became uneasy, the heart and respirations stopped suddenly, the face became cyanosed and the pupils widely dilated. Hypodermic injection of caffein and ether, and an intracardiac injection of adrenalin were administered without success. After eight or ten minutes of artificial respiration, the fetus was extracted by cesarean section. The child was born in a state of asphyxia, but was soon revived. The heart was massaged by the intra-abdominal hand through the diaphragm, intracardiac injections of adrenalin and artificial resuscitation were resumed, but in spite of all efforts it was impossible to bring the woman back to life. At autopsy, the heart was soft, the liver showed fatty degeneration and the spinal canal contained some blood. Brindeau stated that ether or chloroform might also have caused this accident but that it is impossible to tell.

At the Obstetrical and Gynecological Reunion of Montpelier, held February 3, 1926, Devèze, Roume, Madon, Delmas, Coll de Carrera, Rouville and Forgue took part in a symposium on spinal anesthesia, as applied to gynecology and obstetrics. Their individual technics, the indications and contraindications were discussed. The articles dealt largely with spinal anesthesia in purely obstetrical procedures. But little is said about cesarean section as such. Delmas [85] stated, however, that in the course of a cesarean section the uterus emptied of its contents, contracts readily and firmly and that he has never seen secondary hemorrhage.

Devraigne, Suzor and Laënnec [86] reported the case of a secundipara, on whom a low retrovesical cesarean section was performed under lumbar anesthesia on April 4, 1927, for placenta prævia. Ten Cgm. of novocain was injected. The operation was simple, there was practically no bleeding from the segment, no shock was observed and the convalescence was normal and afebrile. Four days after the intervention, April 8, the patient complained of a feeling of weight in the lower limbs and muscular weakness. The next day, April 9, the patient presented an absolutely complete quadriplegia. The lower limbs were paralyzed, and the woman could execute absolutely no movement with them. The reflexes were abolished although sensation was not disturbed in the least. The muscles of the trunk and upper limbs were equally paralyzed and the olecranon and radial reflexes were abolished. The paralysis reached the muscles of the neck and occipital region, although less completely. There was no ocular, lingual or velopalatine paralysis. It was the clinical picture of an extending poliomyelitis, but much more rapid than

an infectious poliomyelitis. Very happily these paralytic phenomena improved rapidly and spontaneously. On April 11th, four days after the onset of the symptoms, the paralysis had disappeared, and the only trace of the disease left was a slight diminution in the muscular strength of the extensors of the lower extremities. On April 26th, the patient was discharged well without any sequelæ.

The reviewer's experience with spinal anesthesia is limited to 9 cases. Eight abdominal cervical and one vaginal cesarean sections were performed under this form of analgesia. The indications for its use were: Active pulmonary tuberculosis in 2 women, acute respiratory tract infection in 5, and valvular heart disease in 2.

The technic employed was the following: The gravida is given 7½ Gr. (500 Mg.) of caffein sodium benzoate. A spinal puncture needle is introduced between the second and third lumbar vertebræ with the woman in sitting posture and the body flexed upon the knees. A syringe is adapted to the needle and a sufficient amount of spinal fluid is withdrawn to dissolve 100 Mg. of novocain crystals (the sterile novocain crystals are available in glass ampuls). The spinal fluid novocain solution is then slowly injected in the spinal canal. The patient is allowed to remain in the sitting posture for two or three minutes, then she is placed in the supine position with the head slightly elevated. After fifteen minutes she is placed in a moderate Trendelenburg position and the operation is begun. Six hours after operation the injection of caffein sodium benzoate is repeated. The anesthesia, in this small group of cases, was very satisfactory. No postoperative headaches were observed, and the puerpera were all free from complications. As far as the low cervical cesarean section is concerned, this is the ideal form of anesthesia, as it makes the operation practically bloodless, and gives all the necessary relaxation in the region of the lower segment. In the Carney Hospital Gynecological and Obstetrical Service, the reviewer used it only when ether anesthesia was contra-indicated, as all the cesarean sections, when possible, are done under this form of narcosis, by far the safest, in his opinion. Spinal anesthesia, again, is not as safe as local infiltration anesthesia, but one operates with much greater ease with the former because of the relaxation, "the abdominal silence" of the French authors.

CESAREAN SECTION UNDER LOCAL ANESTHESIA

Irving's [87] technic is given as follows:

About two and a half hours before beginning the operation the patient is placed in a darkened room adjacent to the operating room, and for the purpose of keeping out extraneous sounds, her ears are plugged with cotton soaked in oil. She is then given, subcutaneously, morphin grain 1/6 and scopolamin hydrobromid grain 1/200. The morphin is not repeated, but at forty minute intervals the same amount of scopolamin is administered until the patient is dozing.

Usually three or four supplementary doses of scopolamin are necessary. When the patient falls asleep a folded towel is placed over her eyes and she is transported gently to the operating room and placed upon the table. A nurse sits by her head and records the pulse rate at frequent intervals, but nothing is said to the patient under any circumstances. Absolute quiet is enjoined upon everyone in the room and the rattling of instruments or basins is carefully avoided. At this point another dose of scopolamin, grain 1/200 is given.

The site of the incision, which starts just below the umbilicus and ends above the pubis, is now infiltrated with 1 per cent novocain, using a hypodermic syringe with a fine needle. With a larger needle and syringe the operator next injects the subcutaneous tissue and partially infiltrates the fascia by a series of punctures made downward at right angles to the skin surface. He now waits five minutes by the clock. If he starts the skin incision earlier he will arouse the patient and immediately get into difficulties. At the end of five minutes he divides the skin and subcutaneous tissue, further infiltrates the fascia and incises it. The peritoneum is now injected with novocain and opened in turn. The lower angle of the incision is drawn downward and to the right, and a stay suture of chromic catgut passed into the uterine muscle just above the bladder reflection of the peritoneum. With this suture left loose, the upper angle of the incision is now drawn upward and to the right, and a second stay suture placed.

As the assistant draws upward on the stay sutures he not only holds the uterus in apposition to the abdominal wall and thus minimizes the spill of uterine contents into the peritoneal cavity, but he also corrects the usual right lateral torsion of the uterus by causing its anterior surface to rotate from right to left. In this way the incision made between the stay sutures will be more nearly in the median line of the organ than if that portion of it were incised which lay originally under the abdominal wound.

Since the uterine muscle and its enveloping peritoneum are insensitive, no novocain is here required. The viscus is opened cleanly between the stay sutures with a sharp knife. If pregnancy has advanced beyond five months, the membranes are ruptured, a foot is grasped and the fetus extracted in the usual manner. If pregnancy has not reached five months, the intact ovum is separated by the finger so that it lies free in the uterine cavity and is extruded through the uterine wound by pressure on the side of the abdomen. In this way one may be sure that the uterus is completely empty.

The uterine musculature just beyond each end of the incision is now transfixed by a long sharpened steel knitting needle which replaces the stay suture. The portion of the organ which we wish to suture now rests temporarily suspended in the abdominal wound, leaving the hands of the assistant free for other purposes, effectively preventing any further spill and acting as a plug to prevent the extrusion of intestines. A towel is now placed on either side of the uterus under the needles and clamped to its fellow of the opposite side above and below. If the patient is in the second half of pregnancy and the placenta consequently has not been removed with the ovum, it is now extracted. The operator then sutures the uterus in three layers, the first continuous, the second interrupted, and the third, the peritoneal stitch, which is continuous, is designed to overlap the serosa and give extra security against leakage through the wound.

Occasionally the patient mutters incoherently during the operation, and sometimes becomes somewhat delirious. This does no harm and need not disconcert the operator. Enough restlessness occurred on two occasions to require primary

ether and on two others to necessitate gas-oxygen. This complication took place among our earlier cases and has been avoided in our later work by the use of the purest preparation of scopolamin obtainable, and by more careful attention to details of technique. Postanesthetic vomiting is of course absent and operative shock is reduced to a minimum.

Thirty-one cases have been operated upon by Newell, Irving and other members of the staff of the Boston Lying-In Hospital at stages of pregnancy varying from seven weeks to full term. Fifteen viable infants were delivered and all survived. No injurious effect of morphin and scopolamin upon the fetus has been noted. It has been Irving's experience that babies thus delivered have cried more promptly than those removed from the uterus when operating under ether anesthesia, and it is his practice to have them taken immediately from the operating room lest they arouse the patient.

Indications and conclusions are given as follows:

Cardiac Disease.—Seventeen cases of heart disease who had been decompensated have been delivered by this method. In seven, previous breaks in compensation had been restored by appropriate treatment. One of these seven patients died of pulmonary embolism on the seventh day after a week of normal convalescence.

There were nine cases in which compensation had not been completely established but in which delivery seemed indicated because the patients were losing ground. One patient died from cardiac failure on the seventh day, and a second, who entered with the additional diagnosis of preëclamptic toxemia and with a blood pressure of 260/160 died of cardiac failure on the third day.

One patient entered in labor, badly decompensated and rapidly growing worse. Abdominal hysterotomy under morphin, scopolamin and local anesthesia was done because it seemed to offer the only possible chance of bringing the patient through alive, but death occurred in twenty-four hours from cardiac failure.

Cardiorenal Disease.—Two patients with cardiorenal disease were thus delivered with no deaths.

Of the nineteen patients in whom the heart was affected, four died, a mortality of 21 per cent. If we deduct the case that died of pulmonary embolus on the seventh day as not being directly due to the condition for which the operation was undertaken, we have a mortality from heart disease of 15.8 per cent. Since all these patients were extremely bad surgical risks we feel that our mortality would have been higher had we adopted any other method of delivery.

No further deaths occurred in the remaining twelve cases, which were operated on for the following indications: Nephritis, 2 cases; pulmonary tuberculosis, 3 cases; diabetes, 2 cases; one of whom had previously had a cesarean section.

Other Indications.—Three cases remain, all of whom had previously been delivered by cesarean section. One had acute bronchitis and was in labor, the second bronchial asthma and the third requested this method to avoid the discomfort of general anesthesia.

1. Abdominal hysterotomy offers a method of emptying the uterus easily and rapidly in those cases where such a procedure is demanded.

2. Local anesthesia under morphin and scopolamin narcosis is superior to general anesthesia because any possible danger from an inhalation anesthetic is eliminated and operative shock is reduced to a minimum.

3. This method is, therefore, applicable to patients classed as bad surgical risks. Among such are cardiacs with previous decompensation, nephritics, diabetics, the pulmonary tubercular, or those who have acute respiratory infections upon whom it is necessary for other reasons to perform cesarean section.

De Lee,[88] in an article describing his method of performing the low or cervical cesarean section under local anesthesia, stated that at the Chicago Lying-In Hospital five operators had performed 67 laparotrachelotomies under local anesthesia alone or aided with a little ether or gas.

He does not give morphin or any other narcotic before the delivery of the baby as he has found many children are narcotized and require prolonged efforts at resuscitation.

He uses 0.5 per cent novocain to each ounce of which two drops of 1:1000 adrenalin are added, after it is sterilized. He insists on making the patient comfortable on the table, such as padding the back and shoulders with pillows, as many women complain more of the strained posture than of the pain of the operation.

He first infiltrates the skin, keeping the needle moving to avoid injecting in a vein. After the skin is benumbed, a little novocain is injected into the fat, but this tissue is not sensitive except near the pubis. The skin and fat are incised. With a short needle the solution is injected just under the fascia using more of it near the pubis; the anesthetic must be injected slowly into the fascia itself. After a few minutes the fascia is opened with a knife. Now the fascia is lifted up and 5 c.c. of the solution is deposited near the outer border of the rectus muscle on each side and in three places. The terminal intercostal nerves enter the rectus sheath here and by benumbing them the parietal peritoneum is desensitized. He also injects some more solution under the peritoneum itself, for a distance of 6 cm. on either side of the proposed opening and into the cavity of Retzius. The peritoneal cavity is next opened.

Next, 20 cm. of the solution are injected into the subperitoneal space of the vesico-uterine plica; with the fingers, this is worked down beneath the bladder and outward to the region of the broad ligaments.

De Lee does not desensitize the uterus unless the patient is in active labor. Then a few c.c. are injected in the line of proposed incision. If the bladder is very tender he places a few c.c. under its lowest portion.

The delivery of the child is always accompanied by a little pain. Half of the women can and do stand this pain; to the other half a little gas is administered at this stage.

After the birth of the child, three hypodermics are given—1 c.c. of pituitrin, ¼ Gr. of morphin and 1/200 Gr. of scopolamin. The placenta is delivered by traction on the cord, aided by the uterine expulsive efforts. This is done in preference to insertion of the hand, as the latter causes pain.

The technic of the operation is that described by De Lee in other articles. The surgeon must work slower and with greater gentleness, using delicate knife dissection rather than the stripping of tissues.

The indications for the 67 cesareans under local anesthesia were:

Contracted pelvis with mechanical disproportion	37	Eclampsia and threatened eclampsia (3 and 8 respectively)	11
Contracted pelvis with abnormality of mechanism	7	Heart disease	4
Placenta prævia	1	Ovarian cyst complicating labor	3
Abruptio placentæ	2	Diabetes and contracted pelvis	1
		Fracture of pelvis	1

There was no maternal mortality. One baby succumbed six hours after delivery. It was four weeks premature and autopsy showed almost complete atelectasis pulmonum. One was dead and macerated—a case of chronic nephritis.

There were 18 cases with postoperative temperature of 100.4° or over (27.7 per cent), of which cases the temperature was 101° or over in 13.

The causes of fever were:

Bronchitis	2	Mastitis	1
Pyelitis (in one the condition existed before operation)	2	Suppuration of the wound	4
Lochiometra	2	Unknown	7

De Lee gives the following summary:

1. Local anesthesia is not only possible but should be the method of choice for all cesareans including the cervical.
2. The dangers of acidosis and pneumonia are avoided.
3. The postoperative recovery is smoother and quicker than that following general anesthesia.
4. We are permitted through this added safety to extend the indications for abdominal delivery in border-line cases.
5. In heart, respiratory, kidney and liver cases, it is particularly valuable, indeed almost indispensable.
6. If the surgeon will devote a little time to perfecting the technic he will be able to apply it in an increasing number of conditions with increasing benefit to his patients and satisfaction to himself.

McCormick [89] recommended the performance of cesarean section under local anesthesia for the following conditions: Cardiac disease, nephritis, cardiorenal disease, eclamptic primiparæ with rigid cervices, diabetes, pulmonary tuberculosis, bronchial asthma, marked anemia, acute infections, such as bronchitis, pneumonia, typhoid, etc., abruptio placentæ, placenta prævia accompanied by profuse hemorrhage; ruptured uterus and exophthalmic goiter.

He quoted the papers of Irving and De Lee in his article. He gives preliminary morphin and scopolamin, as does Irving, and uses 0.5 per cent novocain. He makes the following statement: "Here Dr. Gudell has again recently come to our assistance by informing us that we no longer need greatly fear drug asphyxia of the baby, so long as we have a supply of carbon-dioxide at hand." He does the classical cesarean through a low abdominal incision and

does not inject the uterus. He claims an easier convalescence and feels that local anesthesia is not used enough.

Mowery [90] reported 3 cases of classical cesarean section under local anesthesia and stated the advantages of the method as follows:

First, it is free from danger, for both mother and child. Second, there is no post-operative nausea and vomiting, the abdominal muscles remain quiet, consequently the mother is decidedly more comfortable. Third, shock is absolutely prevented. Fourth, acidosis, fatty degeneration, post-operative pneumonia and paralytic ileus are not produced or even approached. Therefore, the patient's resistance is reserved and the effects of any infection which may have been introduced during or preceding operation are greatly reduced. Fifth, there is no danger of producing cerebral hemorrhage or emboli. Sixth, in complicated cases which are already taxing the patient's resistance to its capacity, as renal insufficiency with albumin, casts, and high blood pressure, profuse hemorrhage, organic heart disease, chronic infection, exopthalmic goiter, etc., in which inhalation anesthesia is decidedly hazardous if not absolutely prohibitive, local anesthesia is used with safety, the patient returning from the operating room without any perceptible change in her general condition.

The disadvantages are few. There may be a little pain while the uterus is being delivered, but not as much during the entire operation as is occasioned by one good labor pain. The time required is a trifle longer, but the condition of the patient remains the same throughout the operation and time is not a factor, as the entire operation seldom requires over 25 to 30 minutes. Perhaps the most objectionable feature is the dread the patient or her relative may have of an operation while conscious. A little properly directed persuasion will usually overcome this. Now if in local anesthesia we have a method comparatively free from objections whereby we can safely operate desperate cases, why, then, is it not logical to extend its application and advocate a more general use of this improved method?

Waldstein [91] summarized his article by saying that by fixing the uterus before incision it is possible on the one hand to block off the abdominal wound, and so prevent the leakage of liquor amnii into the abdominal cavity, also to prevent a possible protrusion of intestines in the region of the wound, and on the other hand to prevent or restrict traction on the ligaments of the uterus. By this means it is possible to keep the uterus in position and so perform the operation painlessly under local anesthesia. Summarizing briefly, he most warmly recommends and advises local anesthesia with temporary fixation of the uterus, as the method of choice in the performance of classical cesarean section. His article contains two case reports.

Keller [92] concluded, in an article entitled "Narco Local Anesthesia in Cesarean Section," that the strain of labor may be lessened without greatly increasing the risk to the patient, by performing narco local cesarean for certain constitutional conditions (chronic endocarditis, chronic pulmonary tuberculosis, acute bronchitis with prolonged gestation, pyelitis with infection of the kidneys, hyperthyroidism, influenza, etc.). Narco local is much safer than ether in most of such conditions.

Frey [93] wrote that, on account of the bad effects often observed after general anesthesia in connection with cesarean section, he as well as a number of other surgeons, has tried local anesthesia with good results.

Since October, 1920, his clinic has used local anesthesia in all cases of abdominal cesarean section except in those cases involving eclampsia. In this clinic, local anesthesia is accomplished, especially in patients having cardiac disturbances, not with a combination of morphin and novocain but with novocain alone. If, in preparation, one wishes to use a central sedative, somniferin is recommended.

In the summary, he said: "By the use of this technic of local anesthesia, abdominal cesarean section may be performed, either by longitudinal or transverse incision, with local anesthesia in the anterior wall of the abdomen. This will prevent deaths caused by anesthesia."

The reviewer has personally performed 10 abdominal cesarean sections under local anesthesia, 5 of the classical type through a suprapubic incision and 5 low cervical operations. In the classical sections he used the Irving method, while in the low cervical ones he used a combination of the Irving and De Lee technics. In addition he always injected the round ligaments before separating the peritoneal flaps. One gravida had two cervical sections under local anesthesia.

For the cases in which the classical section was performed, the indications were the following: Mitral stenosis and regurgitation with decompensation, 2; pulmonary tuberculosis and a previous classical cesarean section, 1; toxemia of pregnancy and influenza, 1; toxemia of pregnancy and lobar pneumonia, 1. Four of these women were at full term while the other had reached eight and one-half months of pregnancy. Two mothers died, a maternal mortality of 40 per cent. The patient who had toxemia of pregnancy and influenza died five weeks after operation of pyonephrosis, the other delivered because of toxemia of pregnancy and extensive lobar pneumonia succumbed six hours after operation. These women were desperately ill and he doubts if they would have survived any other method of delivery. One infant was macerated; the four children born alive all survived.

The indications in the 5 deliveries by the low or cervical cesarean section were: Congenital pulmonary stenosis and decompensation, 2 operations on the same patient; mitral stenosis and regurgitation with decompensation, 3. One mother died, a maternal mortality of 20 per cent; this gravida was admitted to the hospital in a state of decompensation, her heart was fibrillating, and she was cyanotic. She had disregarded all instructions as to rest and was out shopping the day before delivery. She left the operating room in no worse condition than she was when she came to it, but died of acute cardiac dilatation six hours after delivery. The 5 babies lived. The combined maternal mortality for the two series was 30 per cent. High as this may seem, the reviewer is convinced that it would have been still higher had these women been delivered by other methods.

PORRO'S CESAREAN SECTION OR CESAREAN SECTION FOLLOWED BY HYSTERECTOMY

Casper [94] reported the case of a primipara who came to the hospital, after ineffectual attempts at delivery by forceps, with the diagnosis of bony prominence of the sacrum and narrowed anteroposterior diameter. The patient was in fair condition. A Porro cesarean section was performed. Both mother and child left the hospital well.

Countryman [95] described the following case: Miss O., aged 28, was admitted to the Deaconess Hospital (Grafton, N. D.) March 19, 1923, having been in labor eighteen hours, with pains on admission at five-minute intervals, and resembling those of a well advanced second stage. On routine examination it was apparent that an abnormality existed, but the patient was so unruly that an anesthetic was necessary to determine the condition present.

The external genital organs had the appearance of virginity, the labia majora were normal, and the space between was covered with mucous membrane. The urethral orifice was markedly dilated, easily admitting the index finger to the interior of the bladder. No vaginal outlet could at that time be determined, and it was supposed that the vagina opened into the bladder.

By rectal examination the head could be felt well down in the pelvis and the cervix about two-thirds dilated.

A cesarean section with hysterectomy was the only solution of the problem, the latter being necessary as there could otherwise be no provision made for the discharge of the lochia. The operation was completed with no shock to the patient. The hysterectomy was a little more difficult than usual on account of the increased vascularity of the broad ligaments. The child weighed 7 pounds, 8 ounces (3.5 Kg.), was normal and vigorous, and appeared to be of full term. During the operation, when the uterus was removed, the vaginal canal could be readily determined as normal in its upper portion, but ended abruptly with no outlet. On further examination the day following operation, a bloody discharge was noticed coming from the urethra, and, by careful sponging, two small outlets were found opening on the sides of the urethral orifice, each having the diameter of a small probe, and being about 5 cm. in length, opening into the blind vaginal pouch.

The operation was followed by a smooth convalescence. Lactation was established and maintained as usual.

The patient gave a history of menstruation having been established at 15 years of age. The periods were regular and normal, and she apparently had no knowledge of any abnormality.

This case is also of interest from a medicolegal point of view on account of the fact that pregnancy took place from spermatozoa deposited at the urethral orifice, and in spite of the fact that a sinus of 5 cm. intervened between that point and the vaginal pouch.

Spencer [96] reported a case of a primigravida, aged 28, delivered by cesarean section followed by hysterectomy for infected myoma, using Doyen's technic. Perfect recovery of the mother and of a female child, weighing 9 pounds,

10½ ounces. A culture of one myoma gave a mixed growth of *Staphylococcus albus* and a diphtheroid bacillus.

Spencer has operated by cesarean and hysterectomy for myoma in 7 cases. All the 7 mothers recovered, and all the children survived. The first case was subtotal, the last 6 total. He is an advocate of total rather than subtotal hysterectomy no matter what the indication. He mentions the danger of malignant disease of the cervical stump. He has seen 6 such examples, and states that Fletcher Shaw had had 3 cases of cancer of the cervical stump in eighteen months.

Donovan [97] reported the case of a patient, 43 years of age, who had a contracted pelvis, an occipitoposterior position and fibroids. The cesarean section was necessary because of the contracted pelvis; and because of her age and the presence of the fibroids, it was deemed best to remove the uterus. Both mother and baby lived.

Guérin, Valmale and Dias [98] reported a case which demonstrates once more that spontaneous deliveries do not take place in the presence of osseous dystocia. It is an example of an obstruction caused more by a false sacral promontory than by the promontory itself. The cesarean followed by hysterectomy was performed two days after the rupture of the membranes and after repeated manipulations and two forceps applications. Both mother and child were discharged from the hospital in good health.

Guérin, Valmale and Raybaud [99] related the case of a secundipara, 34 years of age, whose first child had been born dead. She was admitted to the hospital in coma, suffering from eclampsia. Cesarean section with subtotal hysterectomy was performed, as there had been repeated manipulations under very doubtful conditions. The child, who was syphilitic, died, but the mother recovered.

Levant and Portes [100] operated on a primipara who had a normal pregnancy. At labor it was found that a septum obliterated the internal os, except for a small opening which admitted the tip of the finger. Delivery of the child, presenting by the breech, was accomplished by cesarean section followed by hysterectomy. Histologically the septum consisted of smooth muscle-fibers; no epithelium was found. The mother and child lived after the operation.

Paucot and Paquet [101] described the case of a woman having Basedow's disease and multiple fibroids, one of which was large and in a position which caused obstruction to labor and premature rupture of the membranes. They performed a cesarean section followed by hysterectomy. The patient made an uneventful recovery.

Picard [102] reported a case of cesarean section followed by hysterectomy in a woman with a contracted pelvis at a time when she was severely infected. Both the mother and child recovered.

Rivière and Lacoutre [103] stated that they believed that obstetrical surgery ought to be practiced along conservative lines when possible. In the presence of an intramural myoma, everything should be done to enucleate it and preserve the uterus. However, in the case of their patient, a primipara, 23 years old, weakened by the hemorrhages of a placenta prævia, and because of that,

more or less predisposed to postoperative infection, it seemed wiser to remove the uterus. The mother and child lived.

Essen-Möller [104] asked, "Is Porro's operation still justifiable?" and stated that the scope of this operation became limited to the infected cases, and it may seem that its rôle was altogether finished, with the introduction of the cervical cesarean section. Yet, such a view seems to be overhasty. Vaginal atresia and extreme stenosis respectively demand the removal of the uterus, if one wants to be sure of avoiding stagnation of the discharge. The obstructing myomata may likewise necessitate an extirpation of the uterus.

Concerning the infected cases, one can also call in question whether in some cases Porro's operation does not give the mother a better chance than a cervical section. For instance, it is difficult to understand why the 44-year-old primipara in his case No. 32 should be exposed to the risk of having her clinical progress complicated by infection only for reasons of principle, when one could most certainly save her from this risk by removing an organ which very soon would be undergoing its senile involution.

It is a much more delicate task to decide whether it is justifiable to perform the same operation on a young woman. Surely, there can be only one opinion that this is nowadays not the proper operation in the case of a primipara, who, therefore, has no living children before and who may lose the one she has got through the cesarean section. But Essen-Möller is not quite as certain that the operation would be inappropriate in the case of a multipara, if one thinks the risk of infection is great, or if another pregnancy is precluded, because of the mother having some disease or other. He is not prepared to express a positive opinion on this point, but states that he should not regard it as a rejectable step, if it has received the careful consideration of an experienced man. For, however good results may have been advanced in favor of the cervical cesarean section, it has nevertheless caused one or two deaths through infection, even though it has been performed by master hands, and the question is whether the mother would not have stood a better chance in such cases, had Porro's operation been resorted to.

Harris [105] referred to a recent statistical report by Eardley Holland on 4197 cesarean sections, which were done in Great Britain and Ireland from 1911 to 1920. In the series there were 46 cesarean sections which had been terminated by supravaginal hysterectomy with 8 deaths, a percentage of 17.4 per cent. As this is far in excess of the mortality in his service, it seemed that it might be interesting to study the results which he has obtained and to compare them with those reported by Holland.

From the early days of Harris' service it was noted that the convalescence following supravaginal amputation was more satisfactory and much smoother than that following most conservative sections, with the result that he gradually came to employ the former operation whenever it seemed justifiable, more particularly in two classes of cases: First, as the method of choice for effecting sterilization after repeated cesarean section, and second, as a means of obtaining more ideal results upon patients who were already infected or who were admitted to the service after being long in labor.

In the earlier days of the service many conservative cesarean sections were done in the second stage or late in the first stage, with the idea that the patient should be given a test of labor in order to ascertain whether the head would or would not engage. They gradually learned that this was an erroneous practice and resulted in a relatively high mortality. After this, the performance of conservative cesarean section was limited practically to such patients as could be operated upon at an appointed time before the onset of labor or as soon as possible after the appearance of labor pains; while in the patients who were seen late in labor or who already presented signs of infection, he either did not do a cesarean at all or removed the uterus after its performance. Some idea of the improvement of the results which followed may be gained from the fact that in the first 50 cesarean sections done in the service the mortality was 12 per cent, while in the following 173 operations done up to May 15, 1922, it became reduced to 2.88 per cent.

In 223 cesarean sections which have been done in the obstetrical service of the Johns Hopkins Hospital up to May 15, 1922, the uterus was removed by supravaginal hysterectomy in 64 instances. For purposes of study the 64 cases have been divided into two main groups, the first including all patients from whom the uterus was removed at the first cesarean section, and the second those from whom it was removed at the second or third section, as shown in Tables I and II.

Table I.—Supravaginal Hysterectomy at First Cesarean Section

Late in labor or manifest infection	10
Sterilization	5
Heart disease	5
Atresia of cervix	5
Neglected transverse presentation	4
Myoma of cervix	3
Hour-glass contraction of uterus	2
Apoplexy of uterus	2
Failure of bag or bougie	2
Uncontrollable hemorrhage	2
Dystocia following ventral fixation	1
Total	41

Table II.—Supravaginal Hysterectomy at Repeated Cesarean Section

Late in labor or manifest infection	8
Sterilization	13
Tearing of uterine incision	1
Blocking of outlet by condyloma	1
Total	23

In the 64 patients there were 3 deaths, a gross mortality of 4.68 per cent, which is, roughly speaking, only one-quarter as great as that reported by Holland. None of the deaths was due to infection and only one of them was associated directly with the operation. The latter occurred at a second section upon a multiparous patient with a generally contracted pelvis, from whom the uterus was removed for the purpose of effecting sterilization. Owing to inexperience the operator had difficulty in ligating the left uterine artery, with the result that death from hemorrhage occurred on the operating table. The other 2 deaths are covered by complete case reports which show that one death occurred eight days after operation from acute thrombo-endocarditis with perforation of the aortic valves, and the other occurred shortly after operation, due to a preëxisting renal condition, which had become accentuated by a premature separation of the placenta.

These 3 deaths represent a mortality of 4.68 per cent, but, as has been indicated, only 1.56 per cent could in any way be attributed to the operation. These figures indicate that those of Holland give a distorted picture of the dangers following supravaginal hysterectomy, and indicate that the results obtained in Harris's hands are essentially as satisfactory as in elective conservative sections done at an appointed time before the onset of labor or within the few hours following the appearance of uterine contractions. This is particularly emphasized when one considers that a large portion of these cases, when first seen, exhibited a condition such as to suggest that infection had already occurred.

In this connection it is interesting to ascertain whether the uterus has been unnecessarily sacrificed, thereby ending the reproductive career of the patients. This can be answered only by studying the cases in somewhat closer detail, and the verdict will depend in great part upon one's point of view. As is evident from Tables I and II, the uterus was removed from 18 patients solely for the purpose of effecting sterilization. Five of such operations were done at the first and 13 at a subsequent section.

Whether the removal of the uterus in such cases was indicated depends altogether upon one's point of view; first, concerning the justifiability of sterilization in general, and second, upon whether it can best be accomplished by removing the uterus. Of course, it can be effected in one of two ways, either by doubly ligating the tubes and burying the proximal ends between the folds of the broad ligaments, or by removing the uterus. If the patient, on being questioned, states that she does not desire to menstruate after the operation, the uterus is amputated as the easiest and most satisfactory method of attaining the desired end. In addition to these 18 cases, the uterus was removed from 5 other women suffering with serious heart disease, as it was felt that in their cases sterilization should follow the first cesarean.

Thus, there are 23 patients in whom the prime or secondary object of the hysterectomy was sterilization, leaving 41 on whom it was performed for other indications. Eighteen of these were done frankly on account of the patient coming into the service already infected or late in labor. In addition to these, the uterus was removed on account of atresia of the cervix, in 5

instances, neglected transverse presentation in 4 instances, hourglass contraction of the uterus in 2 instances, failure of the bag or bougie to bring about labor in 2 other instances and dystocia following ventral fixation of the uterus in one instance—a total of 32 cases. With the exception of the cases of atresia of the cervix, all of these 32 patients were operated upon late in labor and after they had been examined frequently by the vagina, and sometimes subjected to unsuccessful attempts at delivery by other methods. In several of the cases of atresia of the cervix the patient had a high temperature at the time of admission, and it was felt that a satisfactory result could be obtained only by the removal of the organ. Adding these cases to those in which sterilization was the prime indication, we find that they aggregate 55 in number, leaving 9 others in which the operation was done for some other cause.

The justification for removing the uterus in the former group of cases lies in two considerations: First, the only death which occurred was an operative accident, as compared with the 9.4 and 26.5 per cent mortality following conservative cesarean section performed late in labor or after attempts at delivery, as shown by Holland's statistics. Furthermore, as shown in Table III, 60 of the uteri amputated were subjected to histological study and in 23 of them definite histological evidence of ascending infection was found in the shape of leukocytic infiltration or actual inflammatory reaction in the mucosa of the cervix and lower uterine segment. Moreover, in many specimens the presence of bacteria could be demonstrated by suitable bacterial stains. On the other hand, in the 27 patients from whom the uterus was amputated at an appointed time at the end of pregnancy or within six hours after the onset of labor, signs of infection were present in only one, whereas in the 28 patients who were operated upon late in the first stage or during the second stage of labor, 18 presented histological evidence of infection.

TABLE III.—HISTOLOGICAL STUDY OF AMPUTATED UTERI

Duration of Labor	Total Specimens	Inflammatory Changes	Percentage
Before or within 6 hours of onset	27	1	3.7
6 to 18 hours	5	4	80.0
Late 1st or 2nd stage	28	18	64.3
TOTAL	60	23	38.3

While it is not Harris's intention to contend that all patients with ascending infection would necessarily do badly, it does, however, seem to him that many of them would have done so, and accordingly, he feels that he has adduced a satisfactory scientific justification for this course of procedure. Moreover, he feels confident that, had the conservative operation been done, or even one of the various types of extraperitoneal, low cervical or flap operations employed, many more of the patients would have died and there would have been results comparable to those obtained in the first fifty cases of his series, as well as with the figures given by Reynolds, Routh and Holland in late operations.

This being the case, he does not feel that the uterus was unnecessarily sacrificed, but on the contrary, he is convinced that the procedure has resulted in saving the lives of a considerable number of women who would otherwise have died.

It is generally believed that premature rupture of the membranes adds materially to the danger of operation, in that it favors ascending infection. In general this is doubtless true, but this material serves to show that ascending infection may be present without its occurrence, as on examination of the history of the patients, in whose uteri histological evidence of ascending infection was present, it was found that the membranes were intact in 9. On the other hand, in the 11 patients from whom the uterus was removed after labor had been in progress for six hours or more, and in which histological examination shows the absence of ascending infection, it was found that the membranes had ruptured in 7 and were intact in 4 instances. While such figures clearly indicate that premature rupture of the membranes does increase the danger of infection, they likewise indicate that the main factor concerned is the actual length of labor, and that whenever it has lasted for more than six hours the probability of ascending infection must always be considered and will increase with every additional hour the labor has lasted.

Furthermore, it is generally admitted that a temperature of 100.4° F. or more during labor raises the presumption of intrapartum infection. Upon studying the material with this in mind, it was found that 9 of the 64 patients presented elevations of the intrapartum temperature. The uterus from 5 of these presented signs of ascending infection, while in the other four it did not. To put it in another way, it might be stated that, in the 23 uteri which presented histological evidence of ascending infection, the condition was preceded by intrapartum fever in only 5 instances. In other words, the infection was preceded by elevation of temperature only in 5 out of 23 instances. Accordingly, we may conclude that, while the occurrence of intrapartum fever raises the presumption of ascending infection, its absence by no means indicates that it has not already occurred. Here again we must draw a conclusion similar to that in connection with premature rupture of the membranes; namely, that the great danger arises from the prolongation of labor rather than from any of the factors upon whose occurrence we have in the past laid much weight.

For these reasons, Harris has come to regard the late cesarean as an extraordinarily dangerous operation, and, in such cases, if we are not prepared to sacrifice the uterus, we must resort to pubiotomy or the destruction of the child if we wish to safeguard the patient, whereas, if we resort to radical measures, we may obtain results comparable to those following conservative cesarean section done at an elective time either before or just after the onset of labor.

Duvillier and Beghin [106] stated that in a parturient the membranes had been ruptured for three days and several attempts at delivery had been made before she came under their care. The shoulder was presenting and a tight Bandl ring was discovered. Version was impossible, there was the possibility of embryotomy, but the fetus was living, and its high station and the

contracted state of the uterus were contra-indications. It was considered simpler and less dangerous for the mother to perform a Porro operation, as the patient already had seven living children. The mother and child both lived.

Fournier [107] reported the case of a primipara operated in her home in the country. She had edema of the vulva. It was impossible to catheterize her as the urethra was flattened and pressed upon by an enormous serosanguineous mass, rolled out and stretched by the fetal head. Edema of the cervix and the lower segment was present. The pelvis was generally contracted with a false promontory. Normal delivery was impossible and resort was had to a typical Porro operation. The mother and child lived. Fournier believes that in case of long labor, where a long journey is necessary, the surgeon should go to the patient, also that the typical Porro operation carries much less shock than subtotal hysterectomy in such cases.

Schockaert [108] reported a cesarean section followed by total hysterectomy, for a fibroma prævia in a woman 37, who had had three normal pregnancies and labors. The mother and child recovered.

Ducaros [109] of Mitelin, Greece, related the history of a 20-year-old primipara at term and with albuminuria. At 10 A.M. she had convulsions and was seen by a local physician. At 4 P.M. she had severe abdominal pain. The patient was pale, the uterus had a ligneous consistency. A diagnosis of premature detachment of the placenta was made. Twenty-four hours later she was seen by Ducaros. Her condition had become worse, her pulse was 135. Intense thirst, woody consistency of the uterus, and anemia existed. Vaginal examination showed a long cervix, no dilatation and the presenting part high. Laparotomy was done. The uterus was distended, discolored, ecchymotic; in other words, the anatomical picture of uterine apoplexy so well described by Couvelaire. On opening the uterus, liquid and clotted blood under enormous tension was found. The child was dead. Operation was terminated by the Porro amputation. The patient recovered.

Audebert and Fournier [110] reported 3 Porro operations:

Case I.—The patient's membranes ruptured before the onset of labor which had lasted over twenty-four hours before her admission to the hospital. The fetal head was overriding the pubis. The cervix was fully dilated, meconium was being passed freely. There were a large caput, marked vulval erythema with considerable yellowish green discharge, endocervicitis and vaginitis and a contracted pelvis. Delivery by the natural passages was impossible. In the presence of this state of infection, a cesarean section followed by the ablation of the uterus was practiced (typical Porro operation). A large drain was introduced in the culdesac of Douglas. The child was resuscitated with considerable difficulty and weighed 3310 Gm. Complications of the puerperium were, persistent suppuration of the cervical stump for two months and an abundant vaginal discharge for several months. The patient finally recovered.

Case II.—A secundipara 26 years old. Previous classical cesarean section for contracted pelvis and cephalopelvic disproportion. The child died on the eighteenth day of bronchopneumonia. Second operation: Because of intense

adhesions which had to be freed the uterus was left in such condition that it would have been unsafe for another pregnancy to occur. For this reason it was removed by the Porro operation. The recovery was satisfactory and the puerpera left the hospital on the thirtieth day. The child at birth weighed 3180 Gm.

Case III concerned a secundiparous rachitic dwarf with marked deformity of the lower limbs and who had had a previous classical cesarean section. At the second cesarean section, extensive adhesions were found. After freeing these a subtotal hysterectomy was performed, because it was impossible to follow Porro's technic; the child weighed 2800 Gm. The convalescence was normal except for a few attacks of cardiac insufficiency which disappeared under the influence of digitalin.

Guéniot [111] reported 2 cases of shoulder presentation treated by cesarean section followed by supravaginal hysterectomy:

Case I.—A secundipara. External version was attempted twice at the end of gestation without success; when first seen by Guéniot, the cervix was fully dilated, the membranes ruptured, and an attempt at internal podalic version had been made. A foot had been brought down but it had been impossible to turn the fetus. By this time the child was dead. The cord was prolapsed, the one foot which was outside of the vagina, together with a tight contraction ring which was present, made it impossible to introduce the hand in the uterus to do an embryotomy. Cesarean section followed by a subtotal hysterectomy with abdominal drainage was performed. She had an attack of epilepsy the same evening. The convalescence was satisfactory; there was slight elevation of temperature the first few days; it became normal on the sixth day. Slight local suppuration with secondary elimination of catgut sutures occurred. She recovered.

Case II.—The patient, a para XII, was admitted with ruptured membranes, for more than a day and a half. Shoulder presentation, one hand protruding from the vulva. All signs of infection were present. Unsuccessful attempt at embryotomy. The extruded arm was removed with scissors. Cesarean section followed by supravaginal hysterectomy. Mikulicz's drain. Early convalescence was fairly satisfactory, but she died on the sixth day. The autopsy showed peritonitis.

The reviewer's series of cesarean sections followed by hysterectomy contains 14 cases. In one of them a total hysterectomy, and in the 13 others a subtotal hysterectomy were performed for the following indications:

Mismanaged labor and frank infection	8
Uterine apoplexy	1
Uterine myomata	1
Uncontrollable hemorrhage	4

All the mothers recovered. There were two stillborn children, who were dead before the operation was undertaken. Of the twelve children born alive one died on the fifth day of hemophilia and infection.

CESAREAN SECTION FOLLOWED BY TEMPORARY EXTERIORIZATION OF THE UTERUS

The Portes Operation

Cesarean section followed by temporary exteriorization of the uterus was first done by Louis Portes at the Maternité de Port Royal de Paris, on the service of Demelin, December 14, 1923. The first case was reported to the Société d'Obstétrique et de Gynécologie de Paris, at its meeting of March 10, 1924. Since the first case was reported a number of these operations have been done in France. See Literature Nos. 112 to 123 inclusive.

The method does not enter into competition with the conservative cesarean section, be it classical or low cervical, but it is of value in neglected cases in which it would be hazardous to undertake the latter methods. It, therefore, is never considered in clean or relatively clean cases. The low or cervical cesarean section has its greatest advantages in the clean or the presumably infected case, but does not offer the same degree of safety that does the Portes operation in the frankly infected or hopelessly neglected case in which an indication for abdominal delivery arises. It is therefore never an operation of choice but one of necessity.

Its largest field of usefulness is represented under four conditions:

1. When frank infection is present, the child is living, and the condition of the pelvis is such that abdominal delivery is indicated.

2. In the presence of infection and of a dead child when delivery by the natural passage, if not impossible, is at least fraught with danger.

3. When any maneuver through the birth canal might result in the rupture of the uterus. The operation is indicated in such a case even though the child is dead. This applies especially in the neglected labor case with marked uterine retraction. In this type of case it is safer than craniotomy on a dead child, or even embryotomy, as either of these procedures performed within a retracted uterus may well lead to rupture.

4. In the presence of a pelvic indication for abdominal delivery with fetal putrefaction and grave maternal infection.

It is a known fact that a woman subjected to long labor and repeated attempts at delivery is a poor risk for an extensive abdominal operation; and yet most authors agree that in that type of case the cesarean section should be followed by hysterectomy because of the greater safety afforded by this procedure. The hysterectomy is often done at the worst possible time, the patient being in a state of shock. In surgery the poor risk is more and more frequently being operated on in two stages, and there is no reason why the obstetrical patient should not receive the benefit of this advance in surgery.

The Portes operation, the technic of which follows, is done in two stages. The first stage consists in making a long abdominal incision, delivering the pregnant uterus, closing the abdominal wall behind it to the cervix, making a high uterine incision, extracting the child, placenta and membranes, closing

the uterine incision and allowing the uterus to remain on the abdomen. This part of the operation is rapid and results in but little shock.

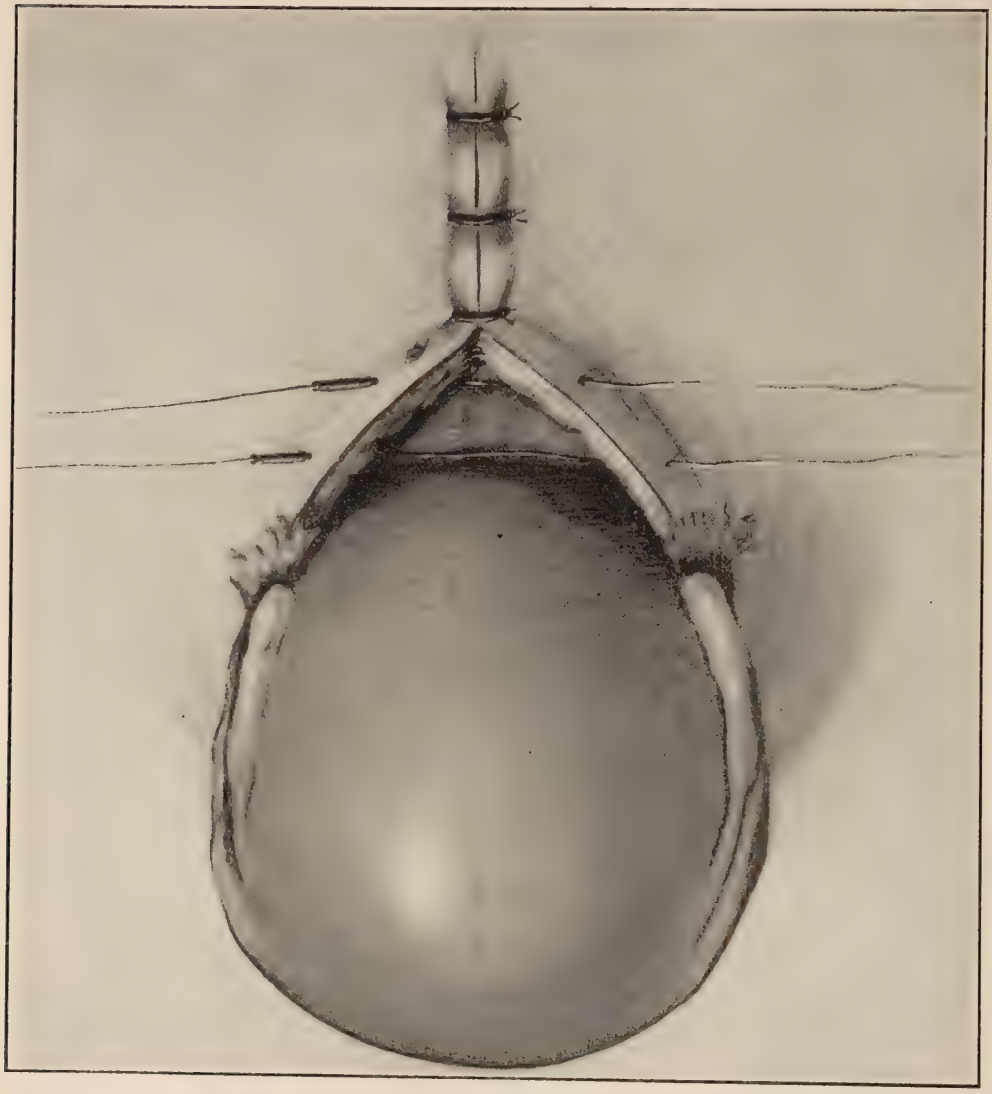

FIG. 1.—PORTES OPERATION.

Median abdominal incision from symphysis to near xiphoid cartilage. The pregnant uterus is strongly anteverted to permit the rapid suturing of the abdominal wall. The sutured abdominal wall is covered with sterile towels; the uterus is dropped on it; gauze wicks are placed around the lower segment and an incision on the anterior uterine wall, encroaching on the fundus, is made. The fetus, placenta and membranes are extracted and the uterine incision is closed in two layers with No. 2 chromic catgut. The uterus is covered with a moist sterile dressing and a tight abdominal binder is applied.

As far as the second stage is concerned, two methods may be used: First, if the patient does well, involution of the uterus is allowed to take place, and when the uterus is clean and the uterine incision well healed, the abdominal

incision is reopened and the uterus and adnexa are replaced in the pelvic cavity. Drainage is placed behind the uterus, and the abdominal wall is closed. If, on

FIG. 2.—PORTES OPERATION

The uterus after involution has taken place and before it is returned to the pelvic cavity. The uterine scar is hardly visible. The abdominal incision is perfectly healed. The tubes and ovaries are slightly edematous but the tubes are patent.

the other hand, the sepsis seems uncontrollable, a hysterectomy may be performed, extra-abdominally, following the Porro technic, after the state of shock has passed. This was done successfully in one case with the patient in bed, without anesthesia. At the February 9, 1925, meeting of the Société d'Obstétrique et de Gynécologie de Paris, A. Couvelaire stated that he knew

of 32 cases in which the Portes operation had been performed and the uterus returned to the pelvic cavity, with 2 deaths or a mortality of 6.2 per cent.

FIG. 3.—PORTES OPERATION

The abdominal incision is reopened; the intestines are protected with gauze. Intestinal adhesions are exceptional.

This mortality is extremely low if one considers the fact that these were cases of frank infection.

All these women who recovered saw the return of their menstrual function and resumed their duties with comfort. At first the obstetrical future of these

FIG. 4.—PORTES OPERATION

The adhesions to the uterovaginal pedicle are, at first, separated with scissors and then with the finger until the pedicle is free from the abdominal wall. The uterus and the adnexa are dropped in the pelvic cavity where they assume their normal positions.

patients was naturally questioned, but it has been proved that a woman with a uterus which has been exteriorized and returned to the pelvic cavity may conceive and carry a pregnancy to term, as shown by the following observation:

At the July 5, 1926, meeting of the Société d'Obstétrique et de Gynécologie

de Paris, A. Couvelaire reported the case of a woman having previously been delivered by the Portes operation, who successfully carried a pregnancy to term. The Portes operation was performed on July 18, 1924, and the parturient was delivered of a male child weighing 7.4 pounds (3430 Gm.). The

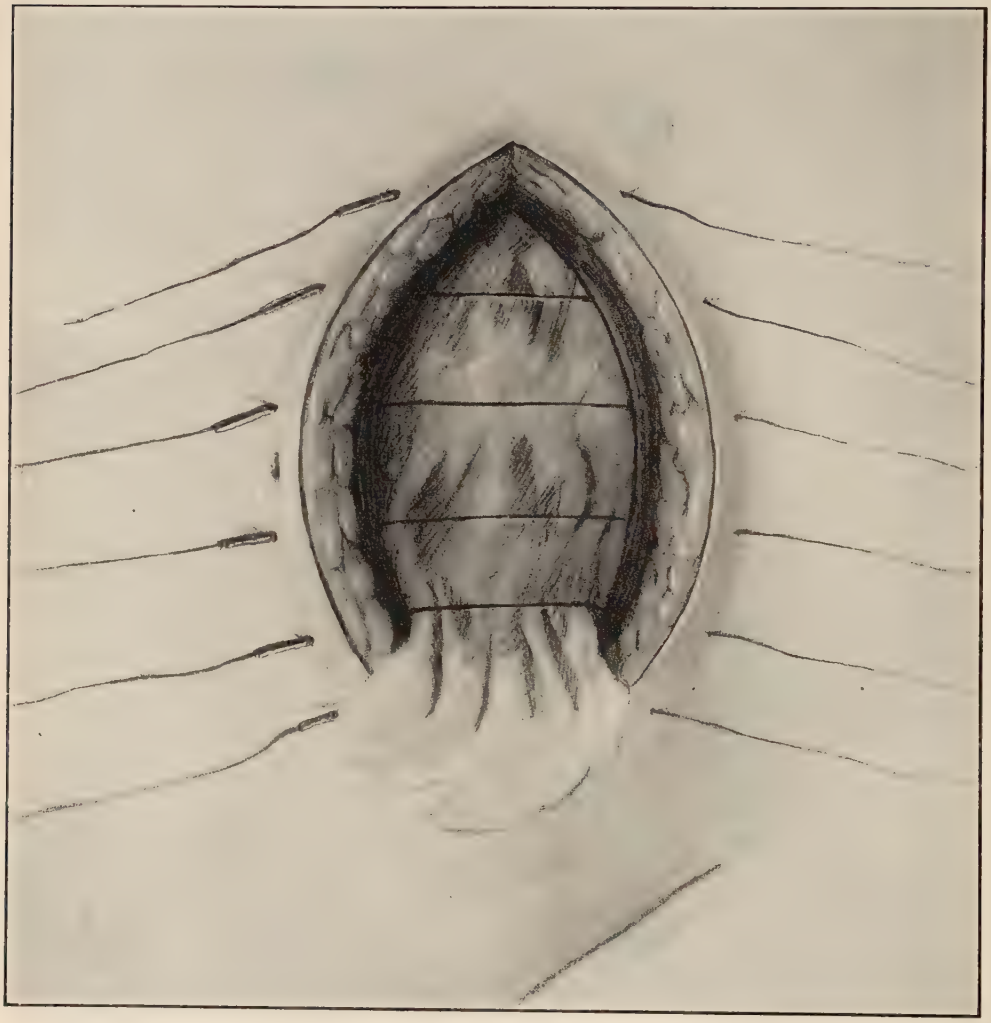

FIG. 5.—PORTES OPERATION

Through and through sutures of silkworm gut booted with fine rubber tubing are introduced. A cigarette drain is placed in the culdesac of Douglas and comes out behind the uterus. The gauze is withdrawn, the omentum is brought down and the sutures tied.

uterus was returned to the abdominal cavity on August 2, 1924, it having been extruded for fifteen days. She left the maternity hospital on August 16, 1924, with her child, and resumed her occupation of housewife. The second pregnancy evolved normally. She started in labor late on July 4, 1926, and early on July 5, 1926, she was delivered at the Baudelocque Clinic, by Portes, by

a classical cesarean section. The child was alive and weighed 7.1 pounds (3250 Gm.). There were only a few omental adhesions to the abdominal wall, the uterus was free and without adhesions, and the uterine scar was good.

The reviewer is indebted to Couvelaire and to Portes for the privilege of seeing this woman and her child at the Baudelocque Clinic, on the day of her delivery, July 5, 1926. Since the publication of the original operation of Portes, the reviewer has been able to collect the details of 17 cases from the literature.

Technic of Operation.—General anesthesia is used and the operation performed in two stages.

First Stage.—The patient is given a general anesthetic and the abdomen opened by an incision extending from slightly above the symphysis pubis to the xiphoid cartilage. The pregnant uterus is delivered, covered with sterile moist towels and turned toward the symphysis pubis. The traction on the uterus should not be too great. The abdominal wall is closed in one layer behind the uterus down to the cervix with double silkworm gut stay sutures booted with small rubber tubing. (In France they use silver or bronze wire.) The closed abdominal wall is then covered with a sterile towel; the uterus is dropped on it and wicks are carefully placed around the cervix to prevent leakage in the abdominal cavity. A high midline incision encroaching upon the fundus of the uterus is made. The low angle of the incision should not be too low so that it will not pull down in the abdominal cavity when involution of the uterus has taken place. The child, placenta, and membranes are extracted and the uterus is sutured in two layers with No. 2 chromic catgut, the first interrupted and the second continuous. (In France they use silk sutures for the deep layer.) The uterus is now covered with dressings and left on the abdomen. A tight abdominal bandage is applied to keep the uterus flat on the abdomen as its anteflexion causes pain.

Second Stage.—When the uterus is clean and the uterine scar is firm, the abdominal incision is reopened up to about the umbilicus. The adhesions are freed from behind the cervix, from the uterovaginal pedicles laterally and from the abdominal wall anteriorly. The uterus is dropped back in the abdominal cavity, and a large cigarette drain introduced into the culdesac of Douglas and allowed to come out of the abdominal wall behind the uterus. The abdominal wall is again closed in one layer with double silkworm gut stay sutures.

The reviewer has performed two of these operations in the last eight months with satisfactory results. In the first case the uterus was exteriorized for forty-one days, in the second for thirty days. Both patients had had attempts at forceps in their homes before admission to the hospital. The infant in the first case was dead *in utero* when he saw her; the second child was born alive and discharged from the hospital in good condition. In both of these women the uterus was so firmly contracted that it was felt that any form of delivery through the pelvis would have resulted in a ruptured uterus.

Cesarean section with temporary exteriorization of the uterus, the Portes operation, is an operation reserved for cases in which infection is severe and

abdominal delivery indicated. The indications for this procedure are, therefore, very limited. At first thought it looks like a very radical method, and yet, in the final analysis it proves to be conservative since it permits preservation of the uterus, tubes and ovaries. The technic of the operation is very simple and can easily be carried out. In reviewing the reported cases it was found that in every case in which the uterus was replaced, the patient recovered. The uterus was left extruding from fifteen to eighty-six days. It is also possible, by this method, to remove the uterus extra-abdominally, if sepsis is uncontrollable, at a time when the patient is out of shock. One woman who had the uterus exteriorized, subsequently carried a pregnancy to term and was delivered of a living child by a classical cesarean section. The function of reproduction may, therefore, be preserved. There is very little peritoneal reaction after the pelvic organs have been returned to the abdominal cavity.

CERVICAL CESAREAN SECTION

In looking over the literature on cesarean section for the last decade one is impressed with the fact that most of the papers deal with the low or cervical cesarean section. At first, entirely extraperitoneal, as the methods of Latzko and Küstner, the operation was modified into the transperitoneal method (Veit-Fromme-Hirst) where the parietal and visceral layers of peritoneum were united to create a so-called extraperitoneal space through which delivery was accomplished, and finally evolved into the intra-abdominal flap, retrovesical operation, which is almost entirely used at the present time. Again, the incision in the cervix may be made longitudinally or transversely, and there are adherents to the two methods. It is a known fact that the low operation is replacing the classical in many important obstetrical clinics.

An impressive contribution on the subject is that of De Lee's [124] in a paper entitled "An Illustrated History of the Low or Cervical Cesarean Section." Starting with the *Lex Regia* of Numa Pompilius, 700 B.C., he follows through its numerous steps the evolution of the cesarean section up to the present cervical operation. This contribution is of interest both from an historical and from a practical operative standpoint.

The cervical operation may be of three types: (1) The true extraperitoneal section represented by the methods of Küstner and Latzko, where the cervix is cleared by lifting off the unopened peritoneal sac from the anterior portion of the inlet, the bladder and the lower uterine segment. (2) The transperitoneal section (Veit-Fromme-Hirst operation), in which a so-called extraperitoneal space is obtained by uniting the parietal and visceral layers of peritoneum. (3) The intra-abdominal retrovesical section, or the modified Sellheim method, which is now replacing the other procedures and is generally employed.

The disadvantages of the true extraperitoneal operation were that (1) the bladder and ureter were not infrequently injured with resulting fistulæ; (2) the peritoneum was occasionally opened during its separation, thus losing the advantage of the extraperitoneal method; (3) the pelvis had to be drained and

this resulted in suppuration and long drainage in many instances; (4) there was more hemorrhage, since the incision in the lower segment had to be made to the side rather than in the median line, and the technical difficulties were greater, and (5) the operation could not be repeated because of adhesions.

The transperitoneal method was the next step in evolution, and was adopted because of its greater simplicity and also because of its lessened technical difficulties.

Krönig brought a new light on the whole subject when he claimed that the better results obtained by these methods were not due to the fact that the uterus was approached in an extraperitoneal manner but because the incision was made in the thin non-contractile lower segment rather than in the thick, contractile body of the uterus. The Sellheim and Krönig operations differ only in small technical details. In these methods the abdominal cavity is protected by thorough walling off with gauze, which is simpler than uniting the peritoneal layers. The incision of the segment at the completion of the operation is entirely retroperitoneal or retrovesical. This simpler method has given results as satisfactory as the first two and has therefore largely replaced them. In this connection we must bear in mind that in the presence of a virulent infection, no conservative method offers any great degree of success, and that the best results are obtained by the removal of the infected uterus.

Cameron,[125] in an article entitled "Technic of Cesarean Section," stated that Frank's procedure of opening the uterus in its lower segment has been more extensively practiced during recent years in Germany and America with the object of abolishing rupture. Modifications of Frank's technic have been introduced from time to time, and the liability to rupture certainly seems to have been diminished, but it should be remembered that the cervical incision is seldom employed in comparison with that in the uterine body. An additional advantage in the cervical operation is that adhesions will be less apt to form. On the other hand, it is an operation for the specialist rather than the general practitioner. Cameron gives three disadvantages to the method, namely, that during extraction of the head hemorrhage may result from extensive tearing of the tissues where a transverse incision had been made, that the transverse wound should be avoided because the muscular fibers in this area are for the most part arranged longitudinally, and finally that the operation must be delayed until the patient is well in labor so as to permit sufficient stretching of the lower segment. The reviewer has not encountered any of these objections in a series of 32 low cesarean sections with the transverse cervical incision, a number of which were done before the onset of labor.

Cameron quoted statistics on 83 cases where his method of performing the cervical cesarean section was used with a maternal mortality of 3.6 per cent and stated that Beck's [126] method differs from the classical operation in that the uterus is incised in the lower segment and an extraperitoneal closure of the uterine incision is effected by utilizing two previously prepared flaps of peritoneum.

The shorter duration of the operation, ease of exposure, fewer technical difficulties, and less troublesome delivery of the child are points in favor of the

classical and may be regarded as disadvantages of Beck's method. They hardly warrant consideration, if experience continues to show that this method offers better protection against hemorrhage, peritonitis and adhesions, and is followed by earlier convalescence and less risk of rupture in subsequent pregnancies.

Welton [127] employed the double-flap low cesarean section in 11 cases, making a transverse incision of the abdomen just above the pubes. All women were potentially infected at the time of operation. Not a single case of peritonitis occurred and the maternal mortality was nil.

He believes that the double-flap method (Beck) offers great protection against extension of infection to the peritoneum from an infected uterus. Adhesions are greatly minimized as the flaps completely peritonealize the uterine wound.

Henkel [128] in general felt that cervical cesarean section should be the method of choice and in special cases he recommends intraperitoneal cesarean section. He recommends it because it can be used in the majority of cases without difficulty and at the same time it can be performed in a brief space of time and usually in fairly typical fashion.

Henkel says that he himself no longer performs extraperitoneal cesarean section since he is convinced that technically it is much more difficult than the intraperitoneal and that it is not possible in every case to be certain of keeping the peritoneum intact, likewise that certain collateral injuries to bladder, ureter, etc., may occur even at the hands of the most skillful surgeon. In addition to this, the operation consumes so much time under certain circumstances that the child may be endangered, and investigations concerning the spread of infection have shown that the danger of infection resulting from operation is much greater for the cellular tissue of the pelvis than for the peritoneum. The conditions of the wound are much more favorable in intraperitoneal cervical cesarean section than in the extraperitoneal. For the present, therefore, he feels that the only advantage of the purely extraperitoneal method lies in the fact that up to the present no cases of peritoneal adhesion have been observed when this procedure was used.

In the technic of cesarean section the question of resistance of the scar in cases of renewed pregnancy plays an important part. There is no danger from the suture if the wound has healed aseptically and the suture has been made correctly. Henkel defines a correct suture as one in which tissues are not mixed, *i.e.*, mucosa is sutured to mucosa, musculature to musculature, peritoneum to peritoneum. Now if peritoneum or mucous membrane is allowed to penetrate into the musculature the resistance of the scar is decidedly reduced. Therefore, surgeons must by all means avoid allowing the mucosa to enter the muscular layer in the suture of the uterus.

Krause [129] stated that the recent publications of Vogt (Tübingen), Martinus (Bonn) and Walthard (Zurich) show more and more that the suprasymphyseal transperitoneal cesarean section is superior to the extraperitoneal. Since practical experience rather than theoretical discussion must cause the surgeon to make his decision in favor of one or the other method,

Krause has used the suprasymphyseal transperitoneal cesarean sections performed in his clinic as the basis of this article.

Since January 1, 1908, the following deliveries by cesarean section were made:

150 transperitoneal suprasymphyseal (among them 125 on account of contracted pelvis)
2 extraperitoneal (1908 and 1909)
11 classical (the last one 1910)
15 posterior cervical (Polano, last 1920)
11 Porro
2 total extirpation

In 13 primiparæ, cesarean section was not performed until it was observed, after a rather long period of labor, that the fetal head showed no tendency to enter the pelvis. Krause wishes to point out that at least a large percentage of cesarean sections performed in his clinic were not clean cases.

In 36 of the women delivered by suprasymphyseal transperitoneal cesarean section this operation or another form of cesarean section was performed the second time, in 23 of these cases a suprasymphyseal transperitoneal cesarean section with delivery of a living child had preceded, two of these children having died after four weeks and two after nine and ten minutes respectively. In 8 cases, the third cesarean section was performed on the patient, in one case there was one classical and one suprasymphyseal transperitoneal, in 2 cases a suprasymphyseal transperitoneal and one according to Polano, in 2 cases 2 according to Polano, and in 4 cases 2 suprasymphyseal transperitoneal cesarean sections had preceded. All the children were born alive and continued to thrive. One woman was subjected to the suprasymphyseal transperitoneal cesarean section four times, and all four children are alive.

In the cases of repeated cesarean section, it was possible to get a view of the adhesions occurring in the abdomen after this operation. In 13 cases there were very light adhesions, usually in the lower part of the scar in the uterus with the scar in the abdomen. Larger adhesions, some wide and some solid bands were found in 5 cases. In 2 cases slight adhesions to the omentum were found. In 12 cases not even the slightest adhesions to the omentum were found. Adhesions with the intestines or in the free abdomen were not found in any case. In most cases nothing could be seen concerning the uterine scar; in 3 cases the musculature was somewhat thin at that point. The abdominal scar was always firm, in no case was abdominal rupture observed.

Wagner,[130] writing on transperitneal cesarean section in eclampsia felt that:

1. After indication for cesarean section has been established, it must be borne in mind that an eclamptic is a patient whose system is poisoned and who would react unfavorably to large doses of a narcotic as well as to lengthy operation. Reductions of temperature must by all means be avoided (operating table must be kept warm). The anesthetic must, therefore, be carefully administered by a skillful hand. Catheterization and shaving during narcosis.

The operation itself must be performed quickly and with a sure hand, consuming, with the author's technic, not more than twenty minutes.

2. Suture. The increased tendency toward infection in eclampsia is well known. For this reason the suture must be absolutely reliable. If infection of the uterus occurs and the suture is not firm and capable of resistance, peritonitis is unavoidable. He usually makes two continuous sutures of catgut and over them a serosa suture of silk. In case of increased danger of infection caused by repeated internal examinations, a fourth suture is made connecting the serosa of the uterus with the lateral peritoneum so that the free peritoneal cavity will not be exposed to infection if such should occur.

3. The physician himself must attend to postoperative treatment. It is necessary that he remain at the bedside for some time to watch the course of events.

Benthin,[131] wrote that the incorporation into operative gynecology of methods involving incision gained ground very slowly on account of the poor success with reference to the mothers. But there has been a change in this respect in the last few decades. Locating the cause of the high morbidity rate, successful removal of injurious factors, improvement of technic, which is continuously reducing the danger of this procedure, careful choice of cases and finally the placing of higher value upon the life of the child, which was often destroyed when other operative procedures were used, all of these factors have tended to greatly widen the indications for abdominal or vaginal cesarean section to great advantage for both mother and child.

But it is true, of course, that only those gynecologists can work successfully who are conscious of the limitations and know the dangers and are qualified to evaluate them correctly and at the same time are entirely familiar with the technic.

The operative method which entirely avoids the natural path of delivery is abdominal cesarean section. It was formerly performed by opening the body of the uterus. Now it is performed in the following manner: After pushing aside the bladder the incision is made in the lower cervical part of the uterus so that after closure, the wound will be outside the actual peritoneal cavity. Sometimes in unclean cases in order to prevent infection, opening of the peritoneal cavity is avoided by making the incision immediately above the symphysis and pushing the bladder, together with the peritoneum, away from the cervix. After opening the cervix, the extraction of the child proceeds entirely extraperitoneally—there is only a wound in the connective tissue.

The operation itself, especially in the transperitoneal procedure, is unusually simple. The fact that the area can be viewed with the eye is responsible for prevention of any great difficulties in operation. The amount of blood coming from the incision wound, even if one should chance to strike the region of the site of attachment of the placenta, is often very small, not even necessitating the use of clamps. Atony of the uterus might occasionally be a disturbing factor, but this can be avoided by the injection of secacornin immediately before making the first incision or later by intravenous injection of hypophysin.

Likewise, the suturing causes no particular difficulties except that it is somewhat more complicated if the original incision is too small and is enlarged by spontaneous rent in the tissue.

The extraction of the child is usually also very simple, especially if the head is so turned that the face will spontaneously enter the incision, thus making it relatively easy to apply the forceps.

The prognosis for the mother has also become much more favorable within the last few years. As late as 1882 the mortality was still equal to 50 per cent or more, while in our day it has been reduced to about 5 per cent of the former rate in various clinics: Bumm, 3.5 per cent; Döderlein, 3.5 per cent; Franz, 2.3 per cent. De Lee and E. L. Cornell even lost only one woman by peritonitis in a total of 150 cases. Benthin himself in a total of 62 cases operated since 1898 had a mortality of only 5 cases, *i.e.*, 8 per cent, which would be recorded as direct results of the operation (total mortality 16 per cent). In cases of contracted pelvis mortality was equal to 6 per cent.

In most cases the course of the puerperium is uneventful. In Benthin's cases the postoperative morbidity rate was equal to 14 per cent (among these 4 cases of parametritis). Richter reported morbidity figures of 27 per cent and Lonne of 17 per cent.

It may be said that since the position of the incision has been changed, so as to be located in the cervix, some of the possibilities, especially ruptured uterus, are becoming more and more rare. In fact, ruptures have rarely been observed in cases of reactionless recovery of the wound. Of course, they are not entirely avoidable. It is, however, noteworthy that King recently reported 2 ruptures among 23 of his own cases. Formation of adhesions is very slight as is observed in repeated cesarean section. Even very difficult and dangerous deliveries have been carried out without injury. Thus, a patient who in 1910 was delivered by cesarean section, in 1912 gave birth by version and extraction, in 1913 gave birth spontaneously, and in 1920 a perforation of the fetal head had to be performed. In 1921 Benthin performed a second cesarean section on this patient and found no peculiarities in the cesarean scar; the same is true of 3 other cases of repeated cesarean section. On the other hand, he recently observed 2 cases in which birth was awaited by the normal process, and he was able to find no peculiarities. The danger, therefore, in connection with later deliveries is very small. This proves, moreover, that the possibilities of success in abdominal cesarean section are remarkably great and that the dangers to the mother are being reduced more and more, and so it is to be expected that a change in the point of view concerning special indications must take place.

Labhardt [132] stated that as a rule in his clinic cervical transperitoneal cesarean section was used, making the incision as near the lower end of the uterus as possible. All previous vaginal examinations should be carefully avoided. Between 1917 and 1925, 200 cesarean sections were performed, 9 died, constituting a mortality of 4.5 per cent. Of these 9 cases, 7 succumbed to complications (3 eclampsia, 1 tuberculous meningitis, etc.) The 2 who died as a result of operation were victims of peritonitis. Of the 104 infants, 38

died, 14 before cesarean section. For the sake of the children, operation is performed under local anesthesia until just before the extraction. Indications: Contracted pelvis, 87 cases (more of them on account of relative disproportion with reference to the head than on account of absolute contraction); placenta prævia, 60. Other indications: Toxic conditions, cardiac disorders, threatening asphyxia, transverse presentation, rupture of the uterus, tumors. Porro's operation is used chiefly in cases of infection and as the most rapid method of combating hemorrhage in cases of eclampsia and placenta prævia.

J. L. Lackie wrote that recent experience of the lower uterine segment incision makes one hopeful that it may be an improvement on the classical operation.

Hodgkins,[133] in his paper, gave the technic of the Hirst operation and gave its advantages as follows: (1) The peritoneal cavity is protected from the spill and there is no handling of bowel; therefore, shock and postoperative intestinal complications are minimized. (2) The layers are rapidly sealed and in the case of a puerperal septic uterus, drainage is extraperitoneal. (3) There can be but few intraperitoneal adhesions. (4) Transperitoneal cervical cesarean can be repeated. (5) The operation is applicable in both clean and infected cases.

Krönig [134] reported a cesarean section in a case of polyarthritis deformans and destruens with ankylosis. The cervical transperitoneal cesarean section was used. This was the only method possible on account of the rigid condition of the patient's arms which lay upon the upper abdomen and could not be removed even under anesthesia. The mother recovered; the child died within three days. Sterilization was not performed because extending the time of operation might have proved fatal in view of her very weak condition.

Quigley [135] reviewed four variations in technique: Krönig, Beck, De Lee, and Hirst. He concluded that the low cervical cesarean section had two fields of usefulness: (1) For the case where because of length of labor, frequent examinations, ruptured membranes or induction of labor, one would hesitate to do a classical section. (2) It permits of a test of labor in the border-line pelvis and because of this many cases can be safely delivered *per vaginam* which otherwise might be subjected to a classical cesarean section early in labor.

Essen-Möller,[136] in an extensive study entitled "Transperitoneal or Extraperitoneal Cesarean Section in Infected Cases," brought out a number of important points. He had already pointed out the classical cesarean section ought not to be performed in these cases. One of the chief reasons of the cervical section has, as we know, been to guard the mother also in infected cases. Has, then, the cervical section proved to answer the expectations in this respect, and how do the transperitoneal and extraperitoneal sections stand in relation to each other?

Out of 194 transperitoneal cesarean sections from Hofmeier, Franz and Baisch no less than 50 per cent were infected, and yet there was only 1.5 per cent of deaths. Out of 444 extraperitoneal cesarean sections half the number had in the same way to be regarded as infected and resulted in a death rate

of 5 per cent. Considering that many of the mothers had high fever prior to the operation, and, furthermore, that the fetus in these cases would have had to undergo embryotomy if one had not wanted to have recourse to Porro's operation, it is quite evident even by this that a new sphere opens to the cervical cesarean section, whither the classical section cannot attain. Our task will then be to investigate which of the two cervical sections can be regarded as superior to the other one.

This task will be rather awkward for Essen-Möller, for the reason that he has not as yet performed an extraperitoneal cesarean section. He is also conscious of the difficulty of appreciating an operation, of which one has no personal experience. In his capacity of clinical tutor it has, however, been his duty to examine the reasons for and against to the best of his ability, and then to take up an attitude toward the question. The following analysis is not meant to be anything but an explanation of his own personal opinion.

One ought then to take into consideration: (1) the technic; (2) the results; (3) subsequent deliveries.

1. As regards the technic of the extraperitoneal cesarean section, its advantage is to be found in the fact that the abdominal cavity is not opened and is thus guarded against becoming infected by the amniotic fluid. Unfortunately, however, the matter stands thus, that this object is not always successfully accomplished, the peritoneum being ever so often opened unintentionally. Küstner, who, as is well known, is the most ardent champion of the extraperitoneal cesarean section, admits this, but asserts as his opinion that the operation can then no longer be classed as extraperitoneal. He does not, therefore, take these cases into account, but refers them to the transperitoneal sections, which is quite justifiable. But, then he ought to state how often he has met with this calamity, which is of great consequence both to the result and to the estimation. Unfortunately, Küstner does not mention anything about that. Guided by the experience of others it is, however, not impossible to appreciate this difficulty. Bumm damaged the peritoneum unintentionally in 30 cases out of 116, thus in about 32 per cent; Wertheim in 38 per cent. As these two are men of great experience, one may quite well presume that others would not arrive at lower figures. Essen-Möller knows only one who has been more successful, namely, Döderlein, who has successfully performed the extraperitoneal operation in 137 out of 145 cases. From these figures it will be evident that not even the most experienced practitioners can always manage to avoid the misadventure in question which he estimates at about one-half of the cases. If, then, the operation is performed in an infected case, it is quite obvious that a lesion of the peritoneum exposes the abdominal cavity to the same risk as an originally transperitoneal operation, even if we consider that the lesion was discovered and immediately stitched. Thus, from this point of view, the extraperitoneal section has preference only in these cases where the peritoneum remains intact.

Concerning other technical difficulties, such as the access to the cervix, the pushing back of the bladder, the risk of bleeding or lesion of some other kind, the reports are contradictory, inasmuch as some consider the extraperitoneal

section to be more complicated, while others, *e.g.,* Lundblad, praise the ease with which it is performed. I think one may agree with Küstner, that technical difficulties must not be the only decisive factor, if outbalanced by advantages in some other respect.

2. The result obtained by the two methods of operation will of course be determinative of the question about their preference. Concerning the mothers first of all, Küstner is able to communicate a series of 183 extraperitoneal operations with 4 deaths, 2 of which were from infection. Considering that 50 per cent of these have had fever previous to the operation, and that Küstner does not allow himself to be deterred from the interference however high the fever may be, one must really admit that the results at which he has arrived are magnificent. The only regret, he has said before, is that they have not learned how many cases have been deducted owing to the peritoneum having been injured.

One will arrive at an equally favorable opinion of the value of the operation in infected or suspected cases, if one examines the results of others. Considering together the 444 cases of Bumm, Döderlein and Küstner, which undoubtedly one is justified in doing in view of the technical skill of these three men, one finds that these cases have resulted in 22 deaths, thus about 5 per cent. Should we deduct the 11 cases, which the parties concerned do not themselves regard as being chargeable against the operation, the death rate would only be half as large. But Essen-Möller is not inclined to such a reduction, at least not for all the cases. The efficacy of the extraperitoneal cesarean section is at all events clearly proved even without making that reduction. The following case, for which he is indebted to a personal communication from Lundblad, is a fine proof of what the operation can accomplish in an infected case: A 29-year-old primipara, in labor for three days, fits of shivering, temperature 39.2° C. Extraperitoneal cesarean section by Lundblad. Subsequent suppuration, which ceased, after Carrel treatment, for ten days. Mother and child were discharged in good health.

If we now contrast these 444 extraperitoneal cesarean sections and their 5 per cent mortality with the 194 transperitoneal cesarean sections of Hofmeier, Franz and Baisch, we find that these latter gave three deaths among the mothers. Equally favorable results are reported by Walthard of Zurich: 206 transperitoneal sections with 4 deaths, thus only 2 per cent. Before the operation 27 of these had a temperature of more than 38° C., 5 of which had postoperative complications, while only 4 of the remaining operated ones suffered from complications. Walthard also performed the operation in cases with permanent fever and is no believer in the extraperitoneal cesarean section. We may mention here that Baisch, too, who was a firm adherent of the extraperitoneal section, has now abandoned it for the transperitoneal.

From what has been said above, Essen-Möller can only draw the conclusion that the transperitoneal cesarean section has given just as good or perhaps somewhat better results to the mothers than the extraperitoneal section, even in positively infected cases. This is really rather surprising. One would expect the microörganisms to be more dangerous for the peritoneum than for the

connective tissue, and a phlegmon to be less dangerous than a peritonitis, even though the latter becomes localized to the lower region of the abdominal cavity. Moreover, it is this theoretical presumption that is always advanced as a support for the extraperitoneal cesarean section. The account given above shows, however, how little weight theoretical reasons carry as against practical results. The end of an infection is determined not only by the seat of the infection but also by many other factors. When Lundblad states that it is not only a question whether the connective tissue or the peritoneum has the greatest resisting power but also in which place we are best able to control an infection that has already begun, then one is inclined to agree with him from a theoretical standpoint. But when he, nevertheless, afterwards expresses the opinion that this is done most easily in the connective tissue, it does not seem as if the results, which I have just now mentioned, confirmed such an opinion.

We have further to examine the results as far as the fetuses are concerned. Two hundred and seventy-nine extraperitoneal cesarean sections by Döderlein and Küstner gave one fetal death, whereas 274 transperitoneal cesarean sections by Franz, Baisch and Hofmeier and Fehling gave 2 fetal deaths. As the number of cases is almost exactly the same in both methods, one may say that the former operation in the most experienced hands has given a fetal death rate that is about five times as large as the death rate of the latter operation. As it is here a question of an operation that is performed in the interest of the fetus, and as the results are not worse to the mother, I think it is hardly possible to come to any other conclusion but that the transperitoneal cesarean section has so far proved itself superior to the extraperitoneal one. For these reasons Essen-Möller has not performed the latter operation, nor is he disposed to do it until it has been proved by experience that it holds just as good prospects for the fetus as does the transperitoneal operation.

In conclusion Essen-Möller just mentioned another point of view for the sake of completeness. Bohrbach has stated that the extraperitoneal cesarean section in 8 per cent of the cases has been attended with abdominal hernia. It is hardly probable, however, that the account of the operation is too much overburdened by this experience, and if draining of infected cases gets more common also after transperitoneal sections, the results of both operations will very likely be about the same.

3. The extraperitoneal section may be performed on the other side at a subsequent delivery, but this seems to be attended with certain difficulties, for Döderlein has only succeeded in doing it in 7 cases out of 20, whereas in the remaining cases he had to have recourse to the transperitoneal operation. As a woman who has once undergone a cesarean section has been told, of course, to turn up at the clinic in good time at a future delivery, the operation can be performed under so favorable conditions that there can be no misgivings either about the transperitoneal or the classical cesarean section.

The opinion at which Essen-Möller has arrived, owing to the preceding investigation, may be expressed as follows: The classical cesarean section is contraindicated in infected cases, unless one intends following it up with Porro's

operation and has to yield to the cervical methods, by means of which it will no doubt be possible to avoid embryotomy of the living fetus even in infected cases. With regard to the two cervical cesarean sections the experience gained up till now seems to indicate that there is nothing much to choose between them as far as the result to the mothers is concerned, possibly with a slight preference to the transperitoneal section. In regard to the fetuses, the transperitoneal section is decidedly superior to the extraperitoneal and is therefore to be preferred, especially as it is undoubtedly more simple from a technical point of view.

Brindeau,[137] writing on the cervical cesarean section, stated that although this operation is performed rather extensively in foreign countries, it has not yet been adopted in France. Schickelé and Brindeau are the only ones who have published results with it.

Brindeau has the statistics of 59 cases, operated upon since May, 1924, and considers this sufficient material upon which to form an opinion of the operation.

We have very extensive statistics on the classic cesarean, comprising many thousands of cases. These statistics show, on the whole, about 8 to 10 per cent mortality, whatever might be the indication for it. Thus it is a serious operation; but as in every operation or every disease, it is necessary to take into consideration the different cases, to arrange them so as to judge of their respective severity. When one undertakes to do this, one perceives immediately that there are two very different varieties of operation:

The cesarean operations performed in clean cases, that is, on women not in labor or right at the beginning of labor with intact membranes, who have not been examined in any way. For these clean cases, the mortality oscillates around 2.9 per cent.

If, on the contrary, one examines the infected cases, that is, the cases of women in labor for several days, having ruptured membranes, the mortality immediately rises to 10.8 per cent. Finally, for the women who have been examined by several persons, and who have undergone at home one or two forceps applications without success, the mortality again takes a great jump to 34 per cent (Routh).

Brindeau refers to the mortality statistics published in 1922 by Kerr and Holland on 4000 cases. The consequence is that, in order to have the very best results in the classic cesarean operation, it is necessary to operate only the clean cases. The operation performed under these conditions becomes comparable to the uncomplicated removal of an ovarian cyst.

The extraperitoneal cesarean operation seeming unsatisfactory, the tendency was to return to the classic operation, but Krönig demonstrated that it is not necessary to fear the peritoneum, and that if the woman died after a corporeal cesarean operation, it was not because the peritoneum had become infected at the moment of operation, but because the serosa had become secondarily infected during the puerperium.

Summarizing, it is Krönig who demonstrated that in simply incising along the lower segment, in passing across the peritoneal cavity (suprapubic trans-

peritoneal cesarean operation) instead of incising along the body, one obtains very much better results.

Again, the only thing which one could truly hold against this operation is that it is longer and more difficult.

What are the results of the low cesarean operation?

It has not been practiced long enough for one to be able to form a very sound opinion; however, we already have numerous statistics. Brindeau mentions a few names: Krönig, Krause, Van Rooy, Aubert, Hirst, De Lee, Beuttner, Gaifami, Phaneuf, Walthar, P. Gall and finally in France, Schickelé and Brindeau himself.

Marassy, one of Brindeau's pupils, wrote his thesis on this subject a few months previously, and gathered 1200 cases operated upon by different authors. Of these 1200 cases, the inclusive mortality is about 3 per cent, which is satisfactory.

Moreover, one encounters uterine rupture from time to time in women who become pregnant again; of 100 cesareanized women, there were 4 ruptures of the uterus on the occasion of another pregnancy; while, in the low cesarean, it appears that this inconvenience would not exist or would be exceedingly rare.

It is in the infected cases that the low cesarean can render the greatest service. Let us compare the mortality in the two varieties of operations:

The high cesarean gives about 10 per cent mortality when one does not consider the infected cases. The low cesarean gives from 2 to 3 per cent mortality for the same group of cases. There is thus a great difference in favor of the low cesarean. Moreover, the opinions of foreign authors are extremely clear: those of Hirst, Krönig, Phaneuf; Schickelé in France is of the same opinion.

Summarizing, in the clean cases, there is not a very great difference between the two operations. Brindeau believes, however, that the low cesarean is preferable. In infected cases, the low cesarean is certainly better. It has the advantage, moreover, of preventing the performance of a certain number of cesareans which are otherwise uselessly performed when one operates at the end of pregnancy.

It also avoids a certain number of pelviotomies—operations of relatively dangerous consequences. It avoids some hysterectomies, since, a short time ago, when one performed the cesarean on a woman, possibly infected, one removed the uterus.

Finally it permits avoiding certain mixed operations, (such as that of Portes) which can render service in very rare cases, but which remain, in spite of all, operations that do not come up to the standard of good surgery.

Ballantyne [138] was impressed with the fact that the cervical cesarean section has considerable vogue in Germany, and Lichtenstein has recorded 143 such operations. In 106 of these cases he performed the intraperitoneal operation, and in the others a form of the extraperitoneal or of the transperitoneal method was employed (in 3 cases it was Frank's, in 11 Sellheim's, in 11 Latzko's, and in 12 Latzko-Zweifel's). The true extraperitoneal plan is much less heard of now than formerly, the difficulty of reflecting the peritoneum

from the bladder without buttonholing, and the fact that in many cases prevention of peritoneal infection is only achieved at the expense of infection of the cellular tissue, have mitigated against its general adoption. McGlinn carefully weighs the advantages and disadvantages, and he finds much that is satisfactory in the ordinary conservative cesarean section as done by Sänger. It ought to be remembered that many operations described as extraperitoneal (*e.g.,* Brodhead's 11 and Langrock's 59) are little removed in reality from transperitoneal, and that not a few of the transperitoneal are truly intraperitoneal. While the genuine extraperitoneal plan has probably ceased to be of practical importance, many obstetricians (*e.g.,* Gaifami) will not agree with McGlinn that the transperitoneal methods do not warrant further investigation and trial; indeed, McGlinn himself finds good points in Beck's operation (a modification of Krönig's). Beck described his procedure in 1919, and he amplified the description in 1921. T. S. Welton has also used the method in 11 instances and thinks it is the operation of choice in all potentially infected cases. It has been termed, "the two-flap low incision cesarean section."

Brandt,[139] in a twenty-four-page article, discussed his ten years' experience with suprapubic section, giving some statistics, likewise details of technic, discussion of indications and time of operation, as well as contra-indications, study of infected cases, course of recovery of mothers and children delivered by section. He concluded with the following summary:

A. With reference to extraperitoneal section:

1. In comparison to intraperitoneal section the extraperitoneal procedure shows certain technical difficulties. The alleged shortening of the time is not so great. In the intraperitoneal procedure the blocking-off process, however, consumes time. In Brandt's clinic, according to the history of the cases, the child is extracted after from five to ten minutes and the operation is completed usually in less than half an hour.

2. The transperitoneal procedure cannot stand as an independent method on the same level as the extraperitoneal and intraperitoneal methods but must be subordinated to these in connection with closing the peritoneum before opening the cervix in the extraperitoneal and in connection with walling off the abdominal cavity in the intraperitoneal procedure.

3. Extraperitoneal section must be divided into two subdivisions, *viz.,* pure extraperitoneal or unlimited extraperitoneal and limited extraperitoneal section. To the latter belong the cases in which injuries to the peritoneum before opening the uterus have been made, so that the extraperitoneal idea is preserved.

4. Extraperitoneal section is accompanied by adhesions which may cause difficulties when the operation is repeated.

5. The extraperitoneal method carries the disadvantage of rents of the peritoneum in connection with extraction of the head, if the cervical incision is too small and the spectrum is grasped too firmly. Because of this there is danger that infectious matter may enter the abdominal cavity.

6. In extraperitoneal section infection does not constitute a contra-indication.

7. In extraperitoneal section the pushing aside of the peritoneum is rendered much easier if the woman has been in labor for some time and the cervix has developed at least to a certain extent.

B. Concerning delivery by section in the cervical canal in general:

1. Suprapubic is to be recommended as a collective term for all abdominal cervical deliveries by section.

2. Trendelenburg's position is not necessary.

3. Longitudinal incision makes possible a good view of the field of operation and is, on account of its simplicity, to be preferred to others.

4. The indication for delivery by section in the cervical canal may be extended to include more cases on account of greater safety to life. Even when the child is dead, section is necessary occasionally in order to save the mother.

5. Complicated measurement of the pelvis is not necessary. Palpation of the pelvis and determination of the diagonal conjugate in cases of contracted pelvis are sufficient. If this does not constitute an absolute indication, observation of the delivery process should be used as a further method in preference to complicated measurements of the pelvis.

6. Drainage is necessary only in cases of infection or when it is not possible to achieve a bloodless wound in the connective tissue. Otherwise, in general there should be primary closure of the abdominal walls.

7. The placenta should be removed through the incision.

8. The cervical scar is very durable. Two layers of sutures are sufficient; the mucous membrane should not be pierced by the major suture.

9. Lumbar anesthesia is considered preferable; Brandt has never observed dangerous effects upon the child.

10. Care should be taken in determining the indication for section in cases of previous operation in contracted pelvis on account of high infant mortality.

11. Artificial abortion is advised only in multiparæ who already have living children.

Holland,[140] in a paper entitled, "The Lower Segment or Cervical Operation," was of the opinion that in spite of the great merits of the classical operation, many surgeons are not entirely satisfied with it, and have devised other methods of abdominal delivery which will avoid the defects mentioned as inherent to the classical. These new operations can all be grouped together under the designation of "cervical" or "lower segment" cesarean sections. As long ago as the beginning of the last century an operation was devised for opening the lower uterine segment extraperitoneally through an incision above Poupart's ligament; it was revived by the American surgeon, T. Gaillard Thomas, in 1870, under the name of gastro-elytrotomy, as an alternative to the ordinary route, in order to avoid the dangers of septic peritonitis. But the operative

mortality was as high or higher, and it quickly dropped out when antiseptics and Sänger's method of suture came in and brought such good results.

The lower segment operation with a greatly improved technic has lately been revived, and its chief exponent in the British Empire is Munro Kerr. The many methods of performing the operation can be divided into extraperitoneal and transperitoneal. These Holland does not discuss, but confines himself to the description of the simple transperitoneal operation, the technic of which has already been mentioned.

Holland has employed this operation so far only 9 times, and has been extremely pleased with it. Its advantages over the classical are, he considers, the following:

1. The wound lies in a quiet part of the uterus, and is at rest during healing. There is no tendency for the edges of the wound to be drawn apart, or for gaps to be formed between the sutures. For these reasons healing occurs under more favorable circumstances than in the classical operation.

2. The uterine incision is made through a less vascular area, and bleeding from the edges is extremely slight.

3. The edges of the wound are thin; suture is therefore easier and quicker.

4. The position of the wound is such that adhesions to the intestines, omentum, or abdominal wall cannot occur; there is only a short line of peritoneal sutures at the bottom of the uterovesical pouch.

5. The uterine wound is covered with a thick layer of fascia and by the bladder, and perfect closure of the peritoneum can be made. For these reasons there is less likelihood of infection of the peritoneal cavity; for it is generally conceded that the source of peritoneal infection is not so much due to contamination by liquor amnii or other uterine contents during the operation as to the subsequent passage of infection from the uterine cavity between the edges of the incision. Should peritoneal infection occur, the lower abdomen is more resistant than the upper.

6. The operation causes less disturbance of the abdominal contents; the intestines are never seen.

7. The scar is in a safer area for subsequent pregnancy and labor, for the lower uterine segment stretches late in labor. The stretching to which the scar is subjected is purely passive, for there is no powerful active drag upon each side of the scar, as there is in the scar of the classical operation.

8. As regards the performance of the operation, it is just as easy to a practiced surgeon as the classical; true, there is more "operating" in it, it is not done, as it were, by two strokes of the knife, as is the classical. The more advanced the patient is in labor, the easier will the operation be and the lower will the incision lie in the lower segment and cervix; in fact, in cases of excessive retraction of the uterus, the incision will lie partly in the upper end of the vagina.

9. So far only one case of ruptured scar has been reported, and this is not a fair case, as the upper end of the incision had to be extended upwards on to the body of the uterus. At the same time it must be remembered that

very few lower segment operations have been done compared to the many thousand by the classical method.

O. Küstner,[141] stated that in his clinic the extraperitoneal cesarean section has been used for a number of years, the total of these operations amounting to 200 at the time of writing. He says that he introduced the method hoping to avoid the perforation of living children, and met with such decided success that he now feels that this ghastly operation is no longer necessary, the maternal mortality in his cases being less than 1 per cent.

With reference to the fever, Küstner states that his cases prove that fever in itself does not contra-indicate extraperitoneal cesarean section. Fever does not necessarily indicate grave infection. If the temperature drops to normal immediately after delivery it is assumed that there was probably only action of toxin due to germs in the liquor amnii and that after this flows out and the child is eliminated the cause of the fever disappears. In other cases there was infection of the tissues, which however was capable of recovery, and it was assumed for these cases that recovery would follow more easily upon an operation which inflicted no wound upon the mother, *viz.*, perforation, than upon a major wound such as the extraperitoneal incision. That, of course seems reasonable. He willingly admits that in the first instance the infection remains localized in the uterus while in the second it is extended to the extraperitoneal incision, so that a longer time would probably be required for recovery, but there is nothing to prevent one from assuming that the germs which do not act fatally within the uterus (whose inner surface, both anatomically and as a fertile field for bacterial infection, has all the significance of a wound) could also be borne without danger in the extraperitoneal incision, especially since this wound is particularly protected against bacterial infection by open surgical treatment. If this were not true his clinic would have had more than 2 deaths from sepsis among their 200 cases, since practically one-half of them ran temperature during delivery.

If, on the other hand, the organisms have a high degree of virulence, the infection attacks the inner surface of the uterus and its substance; whether recovery would occur without incision in cases in which incision would be fatal is the crux of the whole matter, and this is a question which can never be definitely answered. This much is certain, however: In both of Küstner's fatal cases, autopsy showed the endometrium to be seriously infected; from this the incision wound and finally the peritoneum became infected. In both cases there would have been genital infection as grave as that observed in death from puerperal sepsis even if no operation had been performed. Now it is probably logical to assume that after the extraperitoneal incision is infected, peritonitis may more easily occur than from the direction of the inner surface of the uterus. One might suppose that the peritoneal plica, which has been pushed aside, has more permeability for bacteria than the thick wall of the uterus, stretched beyond its limit by days of labor in the presence of a contracted pelvis, and reaching almost the thinness of an intestine. Is it not true that often the entire muscular layer is stretched to such an extent

that only mucous membrane and peritoneal covering remain, a layer no thicker than the peritoneal plica mentioned above? Likewise the autopsies of the 2 cases of sepsis showed nothing to indicate that the peritonitis originated only from the cesarean wound and not at all from the infected uterus.

One is always driven back to the fatalistic résumé: If the gravida is already seriously infected, immediate delivery will in no wise save her, nor will extraperitoneal cesarean section, and the same can be said of perforation; von Redwitz, himself, admits that among his 74 cases of perforated living children there was one case of maternal death.

The view that tympanites of the uterus constitutes an especially unfavorable form of infection cannot be defended in every instance. It cannot be denied that among the gas-forming agents there are often very dangerous forms of bacteria, but in spite of this fact Küstner says that in a number of his cases of extraperitoneal cesarean section he observed escape of gas without grave disturbance to the postoperative course. It is simply impossible during delivery to distinguish fatal infection from the harmless forms. Bacteriological findings leave us entirely in the lurch. Neither the presence of streptococci nor that of other bacteria in the liquor amnii furnish a criterion. Likewise clinical symptoms such as poor general condition, etc., could certainly not be used as a test in a patient who has been under labor for days and nights in the most intense pain and without sleep.

Baumm [142] stated that since October 31, 1922, 133 cases of suprasymphyseal delivery occurred in his clinic in a total of 7018 deliveries. This showed a frequency of operation of 1.9 per cent. Of the 133 mothers, 2 died, showing a mortality of 1.5 per cent. But one of the mothers died of embolism caused by the entrance of air while on the operating table, an accident which has no connection with the operation. Only one woman died of the effect of operation (infection), *i.e.*, these 133 cases show a maternal mortality of 0.75 per cent. This is a decided improvement upon a previous series which showed a mortality of between 2 and 4 per cent.

The results were good in spite of the fact that 52 were not clean cases, *i.e.*, the amniotic sac had been ruptured many hours, the patients were running a temperature and the liquor amnii was malodorous. The 2 cases of death were from this group. The woman who died from embolism was operated upon thirty-seven hours after the rupture of the amniotic sac and showed an os uteri the size of the palm of the hand; the other fatal case was operated ten hours after the passage of liquor amnii and showed an os uteri completely open. The urinary bladder was injured at the time of operation, and the wound suppurated; the patient died forty-seven days later from infection.

From the 133 mothers, 135 children (2 cases of twins) were delivered. Of these, 3 (2.2 per cent) were stillborn or could not be resuscitated. One of them succumbed with distinct signs of intracranial pressure. This infant was extracted forty-one hours after rupture of the amniotic sac, evidently too late even though the heartbeats were still quite good at the beginning of the operation. This corroborates Baumm's view concerning the evaluation of the fetal heartbeat (see *Arch. f. Gynæk.*, 107). The cause of death of the

other two children could not be determined. The one was extracted before rupture of the amniotic sac and in the case of the other one the sac had been ruptured for only one and one-half hours. Autopsy remained negative, likewise Wassermann of the blood from the umbilical cord and retroplacenta. Nor could lumbar anesthesia be looked upon as the cause, because the heartbeats did not decrease materially thereafter, as is so often the case.

Now Baumm adds what he considers a very important fact, *viz.:* that 8 other children died before the mothers were dismissed: 1 from pemphigus, 1 from furunculosis and 6 from the effects of delivery, *viz.,* 1 from erysipelas, beginning at the points of pressure on the skull, and 5 from symptoms of intracranial pressure. From a total of 135 children, 11 were lost, 7 of them without doubt because the operation was performed too late. Therefore, operation should be performed earlier for the sake of the infants. The same conclusion is reached if the course of recovery in the mothers is observed.

Eight mothers enjoyed smooth recovery so that they could be dismissed in good condition between the tenth and twentieth day. On the other hand, recovery was interrupted and delayed in 43 cases, stretching out over a period of three weeks. In the majority of cases delayed recovery was caused by fever with or without suppuration. In 2 cases exudate from the pelvis is recorded, in 2 cases thrombosis of the femoral vein, in 2 cases pneumonia and in one case each fistula of the bladder and abdominal wall, and neck of the bladder. Both fistulæ originated spontaneously, there having been no injury to the bladder during operation. The operation was performed respectively thirty-six and fifty-four hours after rupture of the sac. Late enough to make it clear that from the long-drawn-out pressure, the bladder had become damaged. Besides this, the urinary bladder was injured during operation in 5 cases. This is entirely too often. The cause can be ascribed only in slight degree to defective technic, since the operation has been performed more than 300 times. Baumm suspects that the chief reason lies in the fact that operation was deferred too long, a period of ten to twenty-four hours. Injuries to the bladder were of course sutured; 4 healed smoothly, while the fifth was one of the fatal cases.

It is noteworthy that the 43 cases of disturbed recovery included 34 septic cases and only 9 aseptic. Even if the 43 cases were capable of recovery, it still must be borne in mind that a reduction in morbidity is a prime need and this goal can and must be achieved if the septic cases are eliminated as much as possible, *i.e.,* if operation is performed earlier; it should not be difficult to decide on early operation if the surgeon bears in mind that the operation, if performed in appropriate cases, may be looked upon as involving practically no risk to life. He admits that he is in the face of one of the old established principles of obstetrics and that, in some cases, were operation deferred long enough, delivery might take place spontaneously, but he reminds us that such a procedure would be hazardous to both mother and child. These dangers, he says, are much greater than those of suprapubic section performed at the proper time which shows a mortality of 0 for the child and of 0.75 per cent for the mother. The old conservative therapy in cases of contracted

pelvis shows a much higher mortality for the mother, to say nothing of the child.

For eventual later deliveries the suprapubic does not represent any particular danger. Of the 133 women 30 were delivered by section a second time, 5 a third time, and one a fourth time. In general the operation was not more difficult than it was the first time. At the same time it is noteworthy that in the extraperitoneal procedure, the peritoneum tears more easily each time the operation is performed. That, of course, is easy to explain because there are always more and more scars to loosen, but this seldom interferes with success. He states that in his material he did not find that the scar in the uterus constituted an area of lessened resistance. In the 30 cases of repeated operation all incisions healed very readily, therefore it seems that the operation may be repeated as often as desired in the same woman.

Baumm states that he cannot draw any comparison from his own experience between the extra- and the transperitoneal procedure, since he uses the extraperitoneal operation entirely but he does say that since accidental rents in the peritoneum often occur without serious results, he does not feel that the transperitoneal method should involve much greater risk than the procedure which he uses. His chief reason for choosing extraperitoneal is the fact that it is a decidedly smaller operation and does not open the abdominal cavity.

Klumper [143] thinks that he can draw the conclusion that the method of removing the placenta is a very important factor in connection with secondary hemorrhage in cervical cesarean section. Manual removal of the placenta is not to be recommended; Credé's method is better, and the normal process is best wherever it can possibly be used. There are, however, some conditions in which it seems desirable not to allow the placenta to remain for any length of time after the extraction of the child. In the first place the size of the opening of the cervix must be sufficient, preferably complete dilatation. If there is a possibility that the placenta may not loosen itself readily or if it becomes loosened during operation, it is removed through the incision.

There is a difference of opinion as to whether cesarean section could be deferred until the dilatation is large enough to permit the passage of the placenta. If the amniotic membranes are ruptured, it is not safe to defer operation for so long a time because of the danger of infection. At the same time he believes that in cases in which it is possible to await normal development of the third stage, it is to be recommended. The slight loss of blood is a decided advantage as a result of which the woman can not only resume her daily tasks within a short time but is also able to better overcome an eventual infection (should such occur) after a slight loss of blood than after an excessive loss.

Küstner,[144] in the first part of his article, reported experiments made on rabbits for the purpose of determining whether in cesarean section infants the condition in which they are born is due to asphyxia, action of narcotics, or apnea. He thinks that these experiments showed that the condition in which the cesarean section children are born can probably be explained exclusively by

the action of narcosis and the entrance of ether into the child's circulation. He terms this condition "asphyxia caused by narcosis condition." The respiration is shallow and infrequent and the heart action may be modified—all resembling the condition in adults given too much anesthetic. The anesthetic reduces the sensitiveness of the nerve-centers to carbon dioxid, so that when the child is extracted, the physiological process of respiration does not come properly into play. This occurs in an even more pronounced form when the mother has been given morphin (twilight sleep), as the newborn are more susceptible to morphin than to ether and chloroform. A third factor also coöperates to induce asphyxia in the cesarean section infants: In normal deliveries, the circulation in the uterus, and hence the supply of oxygen to the fetus, is shut off more or less during the labor pains. The blood is overloaded with carbon dioxid, and this would stimulate the respiration center to initiate respiratory movements if it were not that, as the labor contraction subsides, the blood and oxygen reach the fetus. There is thus an intermittent stimulation of the respiration center which, he argues, acts as a kind of preliminary training of the respiratory apparatus, which facilitates the child's breathing when it finally emerges into the atmosphere. Children delivered by cesarean section lack all of this preliminary training. They are born unprepared, and have not learned how to breathe.

In summary Küstner said:

1. The cesarean section infants are in an apneic condition during only a few seconds after delivery.
2. Apnea immediately makes the transition either to normal regular breathing or to asphyxia.
3. Asphyxia is caused either by narcosis of the mother or by absence of the physiological pressure upon the brain during the period of expulsion.
4. Successful combating of asphyxia can be accomplished only by free use of artificial respiration (Schultze's method).

Dujol [145] wrote that the low cesarean operation is still little used in France, but several foreign schools use it right along and almost substitute it for the classic hysterotomy. The principal advantage of this operation would be its innocuity in suspected or infected cases, those where labor has already commenced sometime before, where the membranes are ruptured, where there have been questionable manipulations, where there is a rise in temperature. This operation would then permit of rescuing the child without injuring the mother, in cases where, with the classic technic, one must choose between embryotomy and the sacrifice of the uterus. Thus the limit allowed for natural delivery before practicing intervention in the course of labor would be extended.

Without going so far as Wagner (of Prague) who regards fever as an indication for cesarean, Beuttner, Hauch, and Gaifami, insist that bacterial infection of the uterus is not a contra-indication.

Dujol would like to call attention, however, to the fact that of the 2 cases

reported, it is obviously the second which would appear theoretically to have had the best chance for success; because the patient had only had two questionable manipulations and these practiced under conditions of the greatest asepsis, intact membranes at the time of operation, and a temperature only slightly raised. The other patient, on the contrary, reached the operating table under conditions very much less favorable. It was she, however, who recovered.

This tends to prove that which is otherwise well shown by the experience of others, that the temperature and the number of examinations of doubtful asepsis are not sufficient to prognosticate an infection of the uterine cavity. It is necessary to take into account not only the quantity of the organisms, but their nature and their virulence. Unfortunately, this is a point on which there is nothing to guide one, when one must make a rapid decision in the course of labor, upon which depends both the life of the child and that of the mother.

Yet one word regarding the technic of cesarean of the segment; it is slightly more delicate than that of the high classical. In the 4 cases where Dujol has performed it, he has always had to have recourse to forceps, but the babies did not suffer from this more prolonged extraction. The extraction of the placenta and membranes is also less easy, because it cannot be accomplished in full view, as in the high cesarean, and finally hemorrhage seems more frequent. It is true that one can apparently master this quite easily by irrigation or by applying a compact uterovaginal drain.

Max Wetterwald [146] concluded his article as follows:

On the basis of his study it is evident that the danger of rupture of the uterus is very slight after cervical section. As factors leading to rupture, the following may be considered: Faulty technic of suture, infection of the wound during confinement, lengthening of incision, use of intra-uterine interventions for the purpose of hastening delivery (*i.e.*, version) and especially the occurrence of placenta prævia in the next pregnancy. Surgeons should be very careful in their use of hypophysis extracts. Rapid succession of pregnancies is hardly to be looked upon as a cause of rupture.

In all cases of cervical cesarean section it is imperative that women who have once been delivered by this method should place themselves under the regular care of a physician during the next pregnancy and at the time of delivery be cared for in a clinic.

Couvelaire and Portes [147] recently wrote that since 1906, the date when Frank of Cologne proposed the new technic of abdominal hysterotomy to which he gave the name of suprasymphysic cesarean, the idea of "cesareans" has developed.

The first attempts of Brindeau, of Jeannin, and of Doleris aroused only very moderate enthusiasm in Paris.

In 1922, Brindeau, after a fortunate series of 14 cases, concluded that in the clean cases the classical cesarean is "superior to the low cesarean," whereas in the infected cases he is of the impression that the latter is "less serious than the classical." Since this period, he has continued to study "subpubic cesarean."

Couvelaire and Portes, at the beginning of 1925, commenced to practice low cesarean section extensively by the transperitoneal method. They have practiced it, not only in the cases where the classical cesarean had been used previously, but also in some conditions where they hesitated to practice the latter because of infection established or probable.

They give their impressions gained from their first 30 observations. All their observations refer to the cases of pelvic contraction, in which there is a more or less marked disproportion between the size of the head and capacity of the pelvis. All these operations have been made in the course of labor.

1. In 15 cases, starting from the first pains, without which one deems it useless to attempt the test of labor. In 6 of these cases there was premature rupture of the membranes for a period ranging from two to twenty-one hours.

2. In 14 cases, the disproportion between the head and the pelvis being slight, the test of labor was attempted, but it proved ineffective. It was only tardily that the authors practiced low cesarean section: Seven times because after many hours of good uterine contractions, there was no progress in the adaptation of the presentation to the upper passage of the pelvis; six times because the dilatation being complete, and the membranes having been ruptured artificially, the outlook was not encouraging; once where the course of the test of labor had been assisted by a complete deflection of the head.

In 13 of these cases the temperature was normal at the time of intervention. In only one was there an elevation of temperature, 38.5° C.

3. In one case finally low cesarean was practiced as an emergency measure in a woman brought in with complete dilatation, having already undergone many applications of the forceps.

The following conclusions were reached from this study:

1. From the technical point of view, the low transperitoneal cesarean is less easy, but more satisfactory than the high classical cesarean, because one is under the impression that the suture made upon a portion of the uterus undergoing slight contraction is more perfect and will not subject the cicatrization to the strong contraction during labor which the entire suture of the muscular wall of the body of the uterus undergoes.

2. The immediate results of this operation appear more satisfactory than those of the classical cesarean from the point of view of peritoneal reaction. It is probable that it, better than high cesarean, guards against uteroparietal fistulæ or postoperative ileus from adhesions.

3. It is perhaps less dangerous than high cesarean in cases where the contents of the uterus are not absolutely sterile, but it is probable that in the cases where the contents are infected, the development of operative results will always be in relation to the kind and the virulence of the organisms.

P. Gaifami [148] has made an earlier report in favor of the transperitoneal cesarean incision on the lower segment. He now adds cases and follow up data and says, "The cases reported to the present and the reviews made permit

one to reach a favorable opinion regarding the resistance of the cesarean cicatrix on the lower segment and on the efficiency of the transperitoneal technic not only in doubtful cases, but also in those with undoubted bacterial contamination from the uterine cavity."

Wetterwald,[149] since 1916, found that there have been more than 200 low transperitoneal cesarean sections performed at the Maternité de Saint-Gall. In about half of the cases there was sterilization. As for the others, namely, 101 women in whom there remained the possibility of future conception, the subsequent history of all of them is known. About 45 per cent have had one or more subsequent pregnancies. In 13 cases the low cesarean had to be repeated either at his hospital or in another hospital. Thus, there was opportunity to examine the state of the old cervical cicatrix; in the majority of cases, it was no longer visible or appeared as a thin, white line. With the consent of the parturient it is at the time of this second intervention that Wetterwald, as a general rule, performs sterilization by removal of the tubes.

Franz speaks of 16 cases, in which he performed the low section three times on the same person, Grabich reported 18 cases of repeated operation; dePorenta mentions 3 such, and Gettiker one. Moreover, Franz performed this operation with success 4 times on the same woman.

Besides these 13 women, in whom the cesarean was repeated, 26 had 40 deliveries by the natural passage, without trouble. Of the 26, one was delivered *6 times* spontaneously, another 4 times, a third 3 times, a fourth likewise 3 times; in the last, the first and third deliveries were terminated by forceps. Two other women were delivered twice, one of whom also had the aid of forceps. The other 20 women each had one delivery by the natural passage. Of this number, there was one application of forceps; another time, in breech presentation, extraction was performed; and finally, a case of transverse presentation with prolapse of the cord required version followed by extraction. In the case of one of the 20 women, an extra-uterine pregnancy occurred later, and she was operated upon at another hospital. Thus, all these 40 deliveries were produced at term.

Baumm [150] reported an extraperitoneal cesarean section in a dwarf, 112 cm. tall. Conditions were far from normal. A case of *chondrodystrophia fœtalis*. The suprapubic extraperitoneal method under lumbar anesthesia was used. He always uses the extraperitoneal procedure in spite of the growing number of adherents of the intraperitoneal method.

Snoeck,[151] in a paper entitled "The Test of Labor and the Low Cesarean Section," expressed the views of G. Shickelé, in whose clinic he had spent considerable time. The indications of the low cesarean are being enlarged even to the point of using it in infected cases. Experience has resulted in the fact that a number of clinicians wait to see the result of labor in border-line cases of pelvic contraction. Brindeau advocates this method and Shickelé has only had 2 per cent mortality after the test of labor. This method should only be used in a properly equipped surgical center. The accoucheur must stay near the parturient, and must follow the pulse, the temperature, the blood-

pressure and the fetal heart. The two sources of danger in this temporization are infection and tonic contraction of the uterus. Any negative test of labor must be followed by the low cesarean section. Snoeck further stated that infection is rarely severe after the cervical cesarean operation. The test of labor is ended when the head becomes fixed. According to him this test of labor is applicable even in contracted pelves, as it favors the formation of the lower uterine segment.

Up to the time of writing, Phaneuf has performed 246 cervical cesarean sections; in 214 of these a longitudinal incision was used in the lower uterine segment, while in the last 32, a low transverse incision was made in the cervix. In 56 of these operations the parietal and visceral layers of peritoneum were united by sutures before opening the uterus and in 190 the peritoneal cavity was protected by thorough walling off with gauze.

There were 15 maternal deaths in this series, a gross maternal mortality of 6 per cent. There were no deaths from peritonitis. The causes of death were as follows: Valvular heart disease and myocarditis, 3; acute dilatation of the stomach, 2; uterine apoplexy, 2; pulmonary embolism, 3; eclampsia, moribund on admission, operation in the interest of the child, 3; and pneumonia, 2.

A high percentage of the mothers had had long labor, rupture of the membranes, vaginal examinations and attempts at delivery through the pelvis before being subjected to operation. The fact that there were no deaths from peritonitis in this group shows that a definite protection is offered against spreading infection by this method of performing cesarean section.

There were three sets of twins in the series, 249 infants, therefore, were delivered; of these 15 did not survive or a gross fetal mortality of 6 per cent. The fetal deaths were ascribed to the following causes: Stillborn, 6; macerated fetus, 3; prematurity, 2; atelectasis pulmonum, 3; and congenital heart disease, 1.

In most of the cases where a macerated or a stillborn child was delivered, the indication for operating was a previous cesarean section of the classical or cervical type.

Scar of Cervical Cesarean Section.—Ninety-two cervical operations were performed by Phaneuf, on 39 mothers. There were, therefore, 53 repeated cervical sections. *Four gravidæ had 4 operations, 6 gravidæ had 3 operations and 29 gravidæ had 2 operations.* In 52 out of the 53 repeated sections, the lower uterine segment was found intact, the healing was perfect and it was impossible to distinguish the cervical scar as such. In one case, the forty-fifth in the series, a weak spot was found in the previous scar; this occurred at the second operation in a woman in labor eleven hours. The weak area, which was about an inch in diameter, was found at the upper aspect of the scar and was due to the fact that the previous incision had been extended into the body of the uterus; that part of the scar which had been placed in the lower uterine segment was found to be perfectly healed. It would seem that a transverse cervical incision being wholly placed in the non-contractile tissue might prevent this accident. For this reason Phaneuf has used such an incision in his

last 32 cases. His present impression is favorable. However, only the future and a larger series of cases will prove or disprove this point. There was no difficulty in separating the bladder when performing the repeated operations.

Four gravidæ were delivered through the pelvis subsequent to a cervical cesarean section. One had 3 normal deliveries, another 2 normal deliveries, while the last 2 each had 1 forceps delivery.

Technic of Low Cesarean Section with Longitudinal Cervical Incision.—*First Step.*—Abdominal Incision.—The patient is catheterized, anesthetized and placed in the Trendelenburg position. The abdomen is opened by a median incision about 6 inches long, starting at the symphysis and ending near the umbilicus. A Doyen retractor is introduced at the lower angle of the incision and the lower uterine segment is well walled off with a long strip of gauze. One cubic centimeter of an aseptic preparation of ergot is injected in the thigh muscles.

Second Step.—Longitudinal Cervical Incision; Delivery.—The uterine peritoneum, where it is loosely attached above the bladder reflection, is incised transversely. An upper flap of peritoneum is separated and a low flap of peritoneum, together with the bladder, are pushed downwards. The Doyen retractor is now placed over the bladder to protect it. The assistant makes traction upwards on the uterus to bring the lower segment near the surface. A small longitudinal incision is made, with a knife, at the upper end of the denuded area, in the median line; this is extended downwards with bandage scissors until the incision is sufficiently long to permit the delivery of the child. The child is delivered by raising the head with the hand and making pressure on the fundus. Forceps are rarely necessary. If the breech presents, the infant is naturally extracted by the feet. One cubic centimeter of pituitary extract is injected in the thigh muscles at this time. If the parturient has not had labor, or if the cervix is but slightly dilated at the time of delivery, the placenta and membranes are expressed through the incision. If, on the other hand, the cervix was fully dilated, the cord is tied, dropped in the uterus, and the placenta and membranes are expressed through the vagina after the closure of the cervical incision and the union of the peritoneal flaps.

Third Step.—Closure of the Longitudinal Cervical Incision and Suture of the Peritoneal Flaps.—The cervical incision is closed in one layer with interrupted sutures of No. 2 chromic catgut. These sutures take in the mucosa as well as the muscularis and are placed about half an inch apart. The peritoneal flaps are now united with a continuous suture of No. 0 chromic catgut, thus making the cervical incision entirely retrovesical.

Fourth Step.—Closure of the Abdominal Wall.—The gauze strip is now removed, the omentum is brought down, intestines are practically never seen during this operation, and the abdominal wall is closed in layers in the usual manner.

Technic of Low Cesarean Section with Transverse Cervical Incision.—*First Step.*—Abdominal Incision.—This is the same as in the procedure above described.

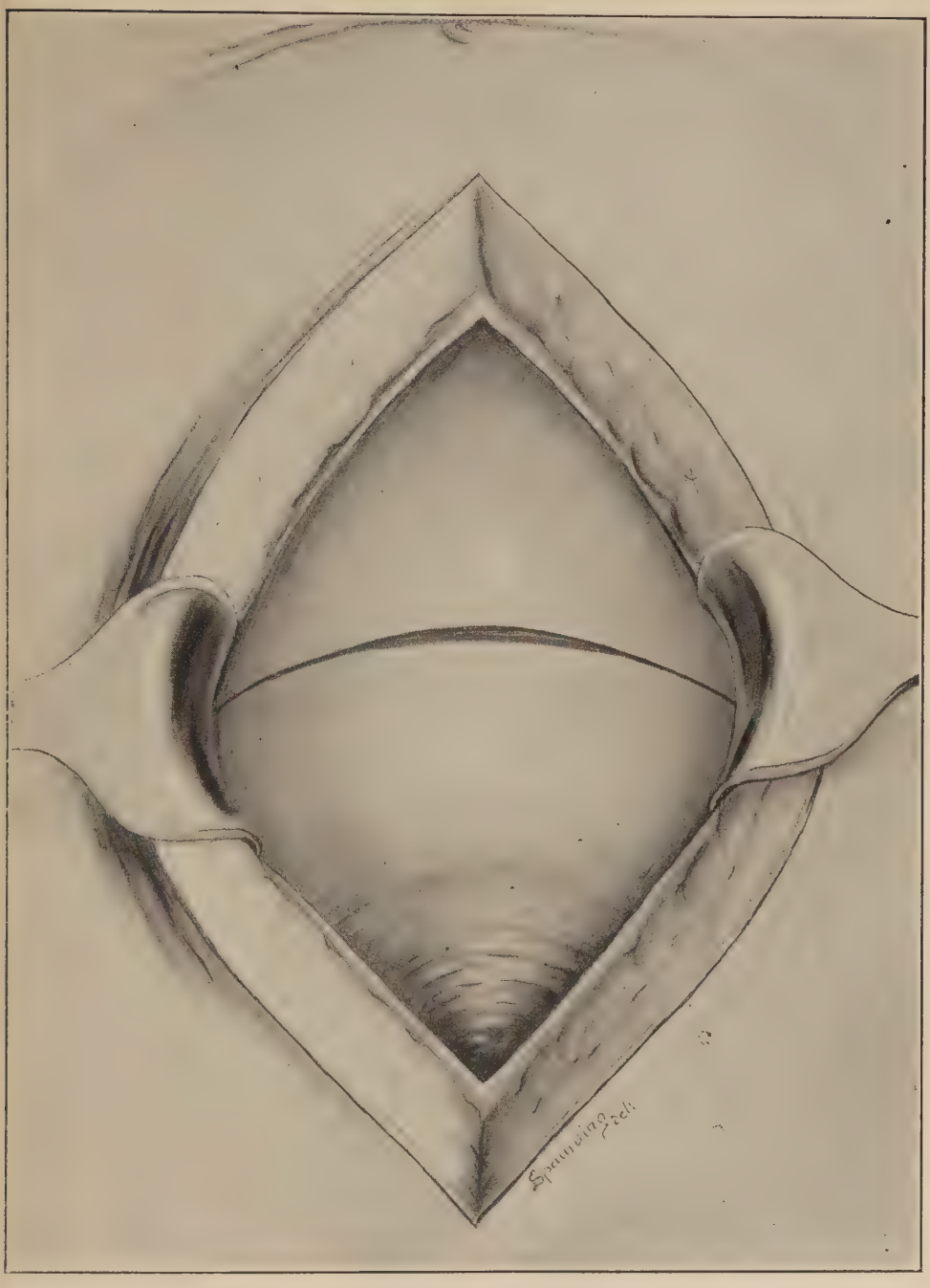

FIG. 6.—LOW OR CERVICAL CESAREAN SECTION

Median suprasymphyseal incision exposing the lower uterine segment. The visceral peritoneum is incised transversely where it is loosely attached slightly above the bladder reflection.

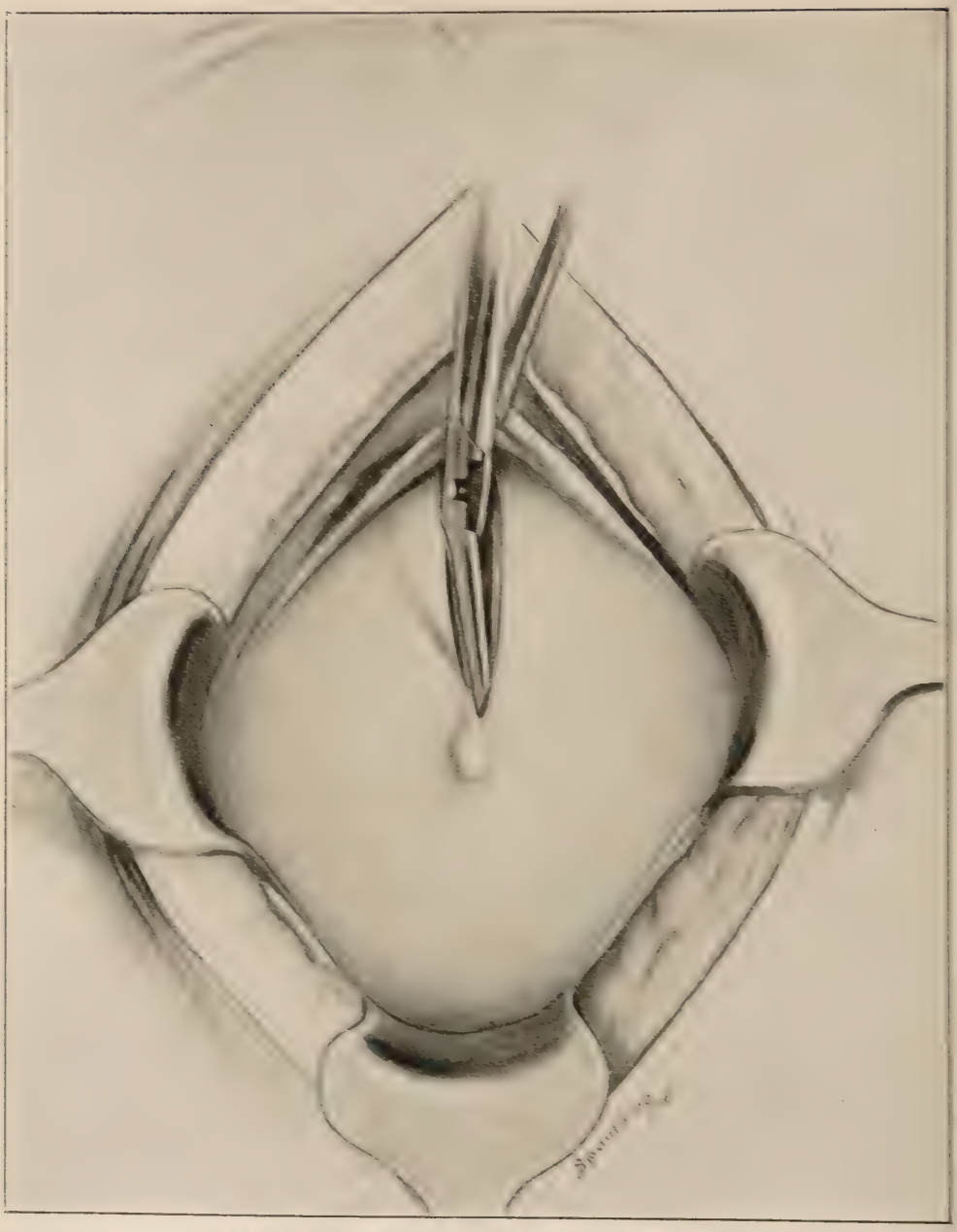

FIG. 7.—LOW OR CERVICAL CESAREAN SECTION.

A lower flap of peritoneum is separated with the bladder which is held under the symphysis by a retractor. An upper flap of peritoneum is raised and is held by an Allis forceps. The lower segment is incised with bandage scissors to protect the child's head.

FIG. 8.—LOW OR CERVICAL CESAREAN SECTION.

With the index finger in the child's mouth the face is turned to the incision. The left hand is introduced under the vertex and pressure is made on the fundus, the head is thus easily delivered. Forceps are practically never used.

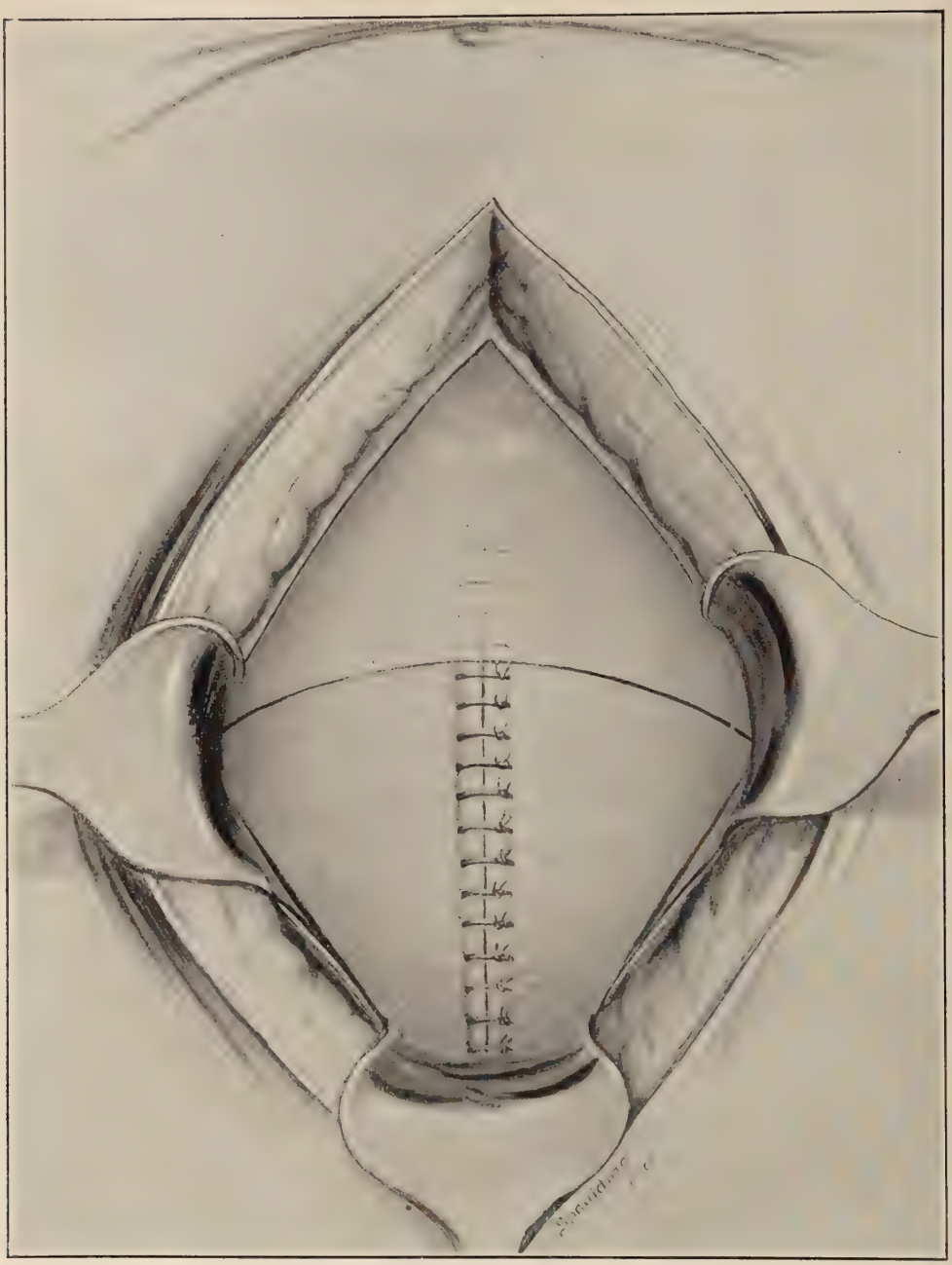

FIG. 9.—LOW OR CERVICAL CESAREAN SECTION.

The cervical incision is sutured, in one layer, with interrupted sutures of No. 2 chromic catgut. The upper flap of peritoneum is brought down but not anchored in any way to the uterus.

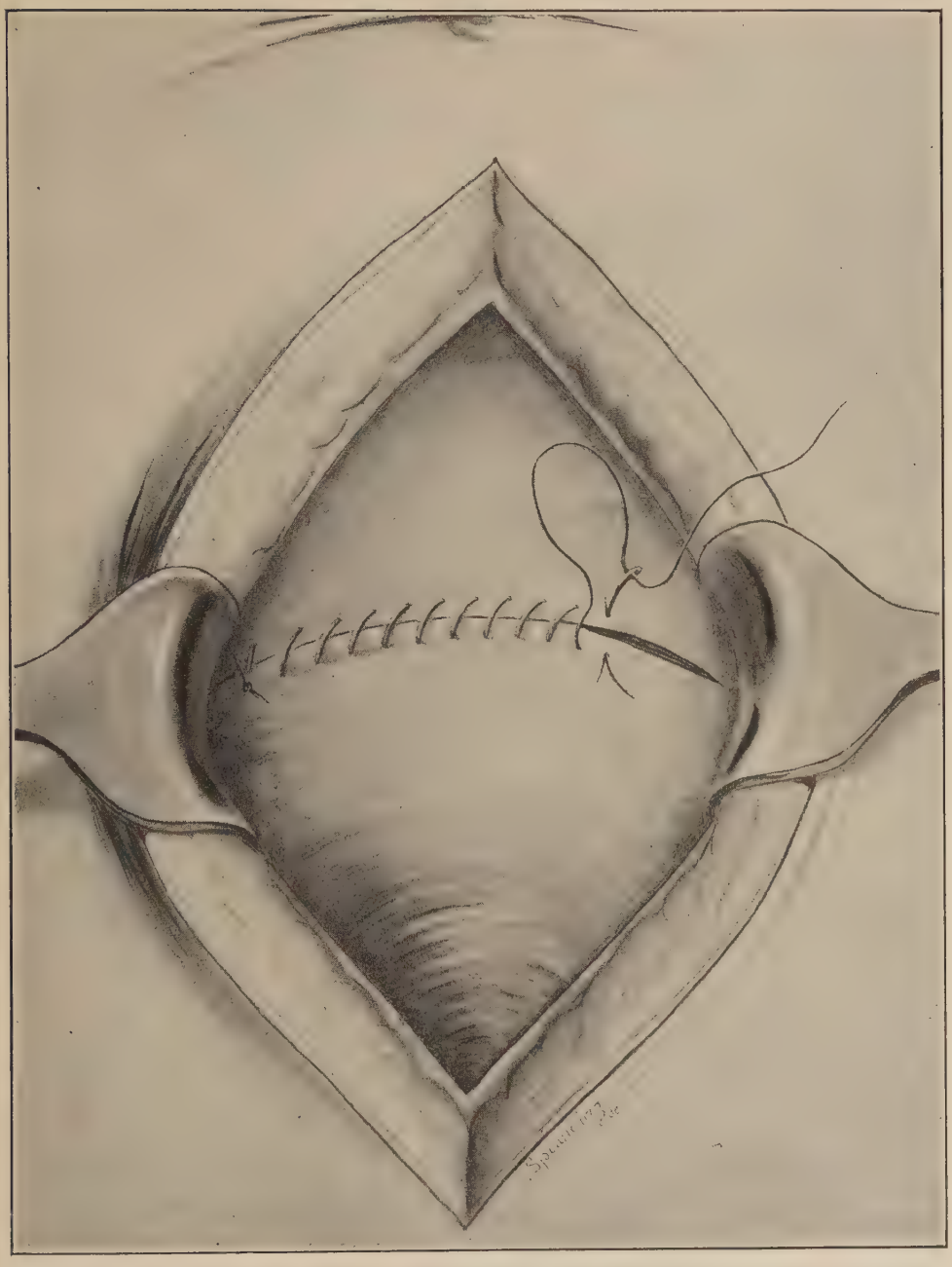

FIG. 10.—LOW OR CERVICAL CESAREAN SECTION.

The operation is completed by uniting the flaps of peritoneum, upper and lower, with a continuous suture of fine chromic catgut. The flaps are not attached to the uterus so as to facilitate the separation of the bladder in subsequent operations.

Second Step.—Transverse Cervical Incision; Delivery.—The uterine peritoneum is incised transversely, an upper and a lower peritoneal flap is made, the bladder is separated with the lower flap. A Doyen retractor is placed over the bladder to protect it. A small transverse incision is made, with a knife, as low as possible in the cervix, in the median line; this is extended laterally with bandage scissors curving the incision upwards, so that the concavity is towards the symphysis. This is done to give more room. The delivery is then accomplished as described above, under longitudinal cervical incision (page 302).

Third Step.—Closure of the Transverse Cervical Incision and Suture of the Peritoneal Flaps.—The cervical incision is closed in two layers with continuous sutures of No. 2 chromic catgut. The first layer takes in the endometrium and part of the muscle. The second layer takes in the remainder of the myometrium and the fascia of the lower uterine segment and completely covers the first. The peritoneal edges are now united with a continuous suture of No. 0 chromic catgut, thus making the transverse incision entirely retrovesical.

Fourth Step.—Closure of the Abdominal Wall.—This is accomplished as described above.

Convalescence.—In his 11 previous communications on the subject of cervical cesarean section, Phaneuf has insisted on the simple convalescence which follows this operation. As his experience with the method increases, he is more and more impressed with this fact. It certainly is not the ordeal of the old classical section. A rare case develops a moderate soft distention, but in his series, it has always been a soft distention causing the puerpera no discomfort. The patients are free from ileus, the temperature and pulse remain near the normal line, and no signs of peritoneal shock are observed. If the operation accomplished nothing more than the comfortable puerperium, it would be worth while doing for this reason alone.

VAGINAL CESAREAN SECTION

The literature since 1921 contains very little about vaginal cesarean section. The great advantage of this method is its extraperitoneal approach of the uterus, therefore the marked increase in safety over the classical operation. Since the more general adoption of the suprasymphyseal or transperitoneal low abdominal cesarean section, it has been found that the increased protection against infection secured by this procedure is almost as great as that of vaginal hysterotomy. For this reason and also because of the simpler technic, the low abdominal operation has been substituted for the vaginal in a number of clinics. This has tended to further limit the indications of vaginal hysterotomy.

At the present time vaginal cesarean section finds its largest field of usefulness when an indication for the rapid emptying of the uterus arises up to the end of the eighth month of pregnancy in:

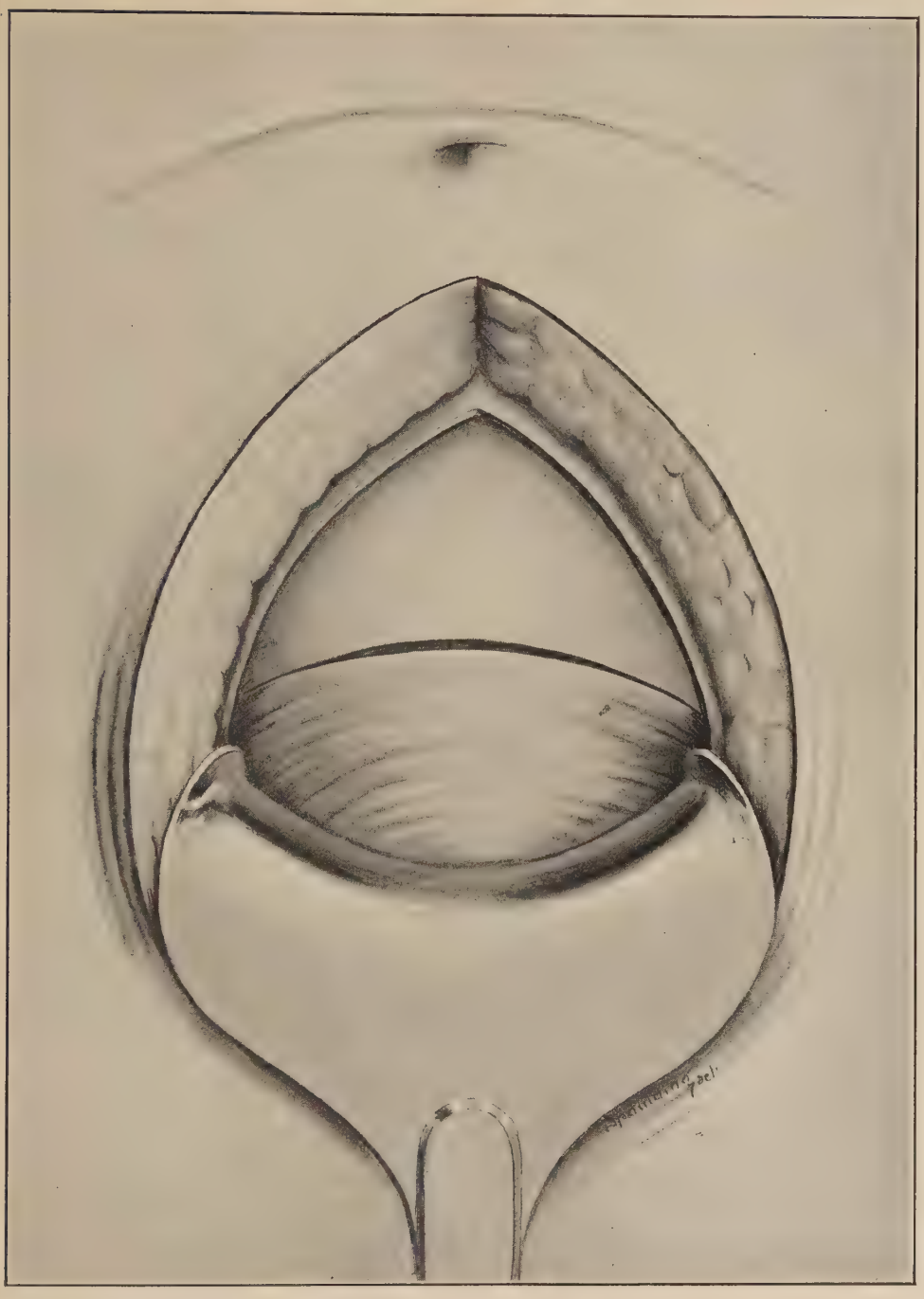

FIG. 11.—LOW CESAREAN SECTION.

Transverse cervical incision. Median suprasymphyseal incision exposing the lower uterine segment. The visceral peritoneum is incised transversely where it is loosely attached slightly above the bladder reflection.

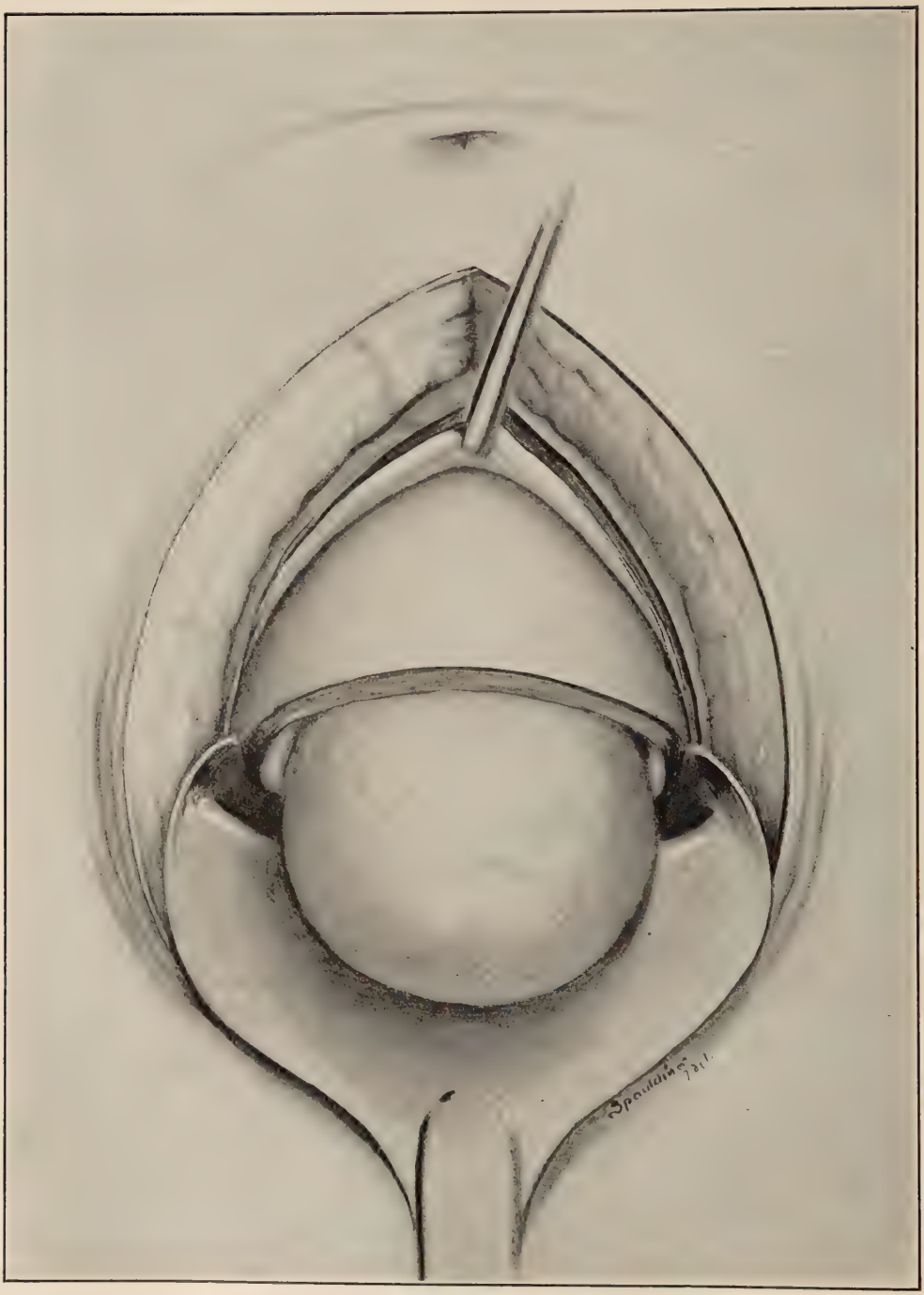

FIG. 12.—LOW CESAREAN SECTION.

Transverse cervical incision. A lower flap of peritoneum is separated with the bladder which is held under the symphysis by a Doyen retractor. An upper flap of peritoneum is raised and held by Allis forceps. The lower segment is incised transversely with bandage scissors to protect the child's head. The vertex is delivered by raising it with the left hand and making pressure on the fundus with the right hand.

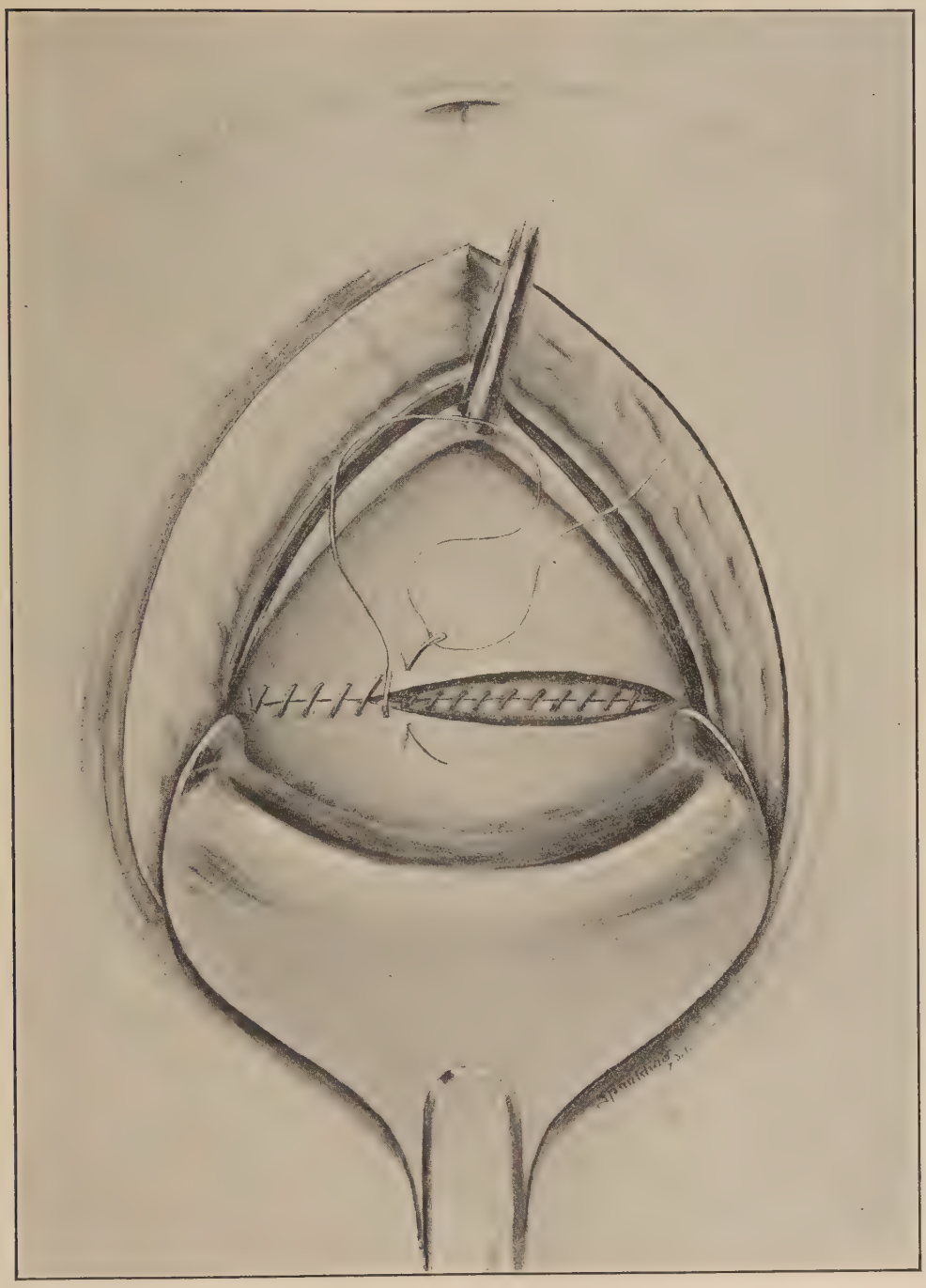

FIG. 13.—LOW CESAREAN SECTION.

Transverse cervical incision. The cervical incision is sutured in two layers with continuous sutures of No. 2 chromic catgut.

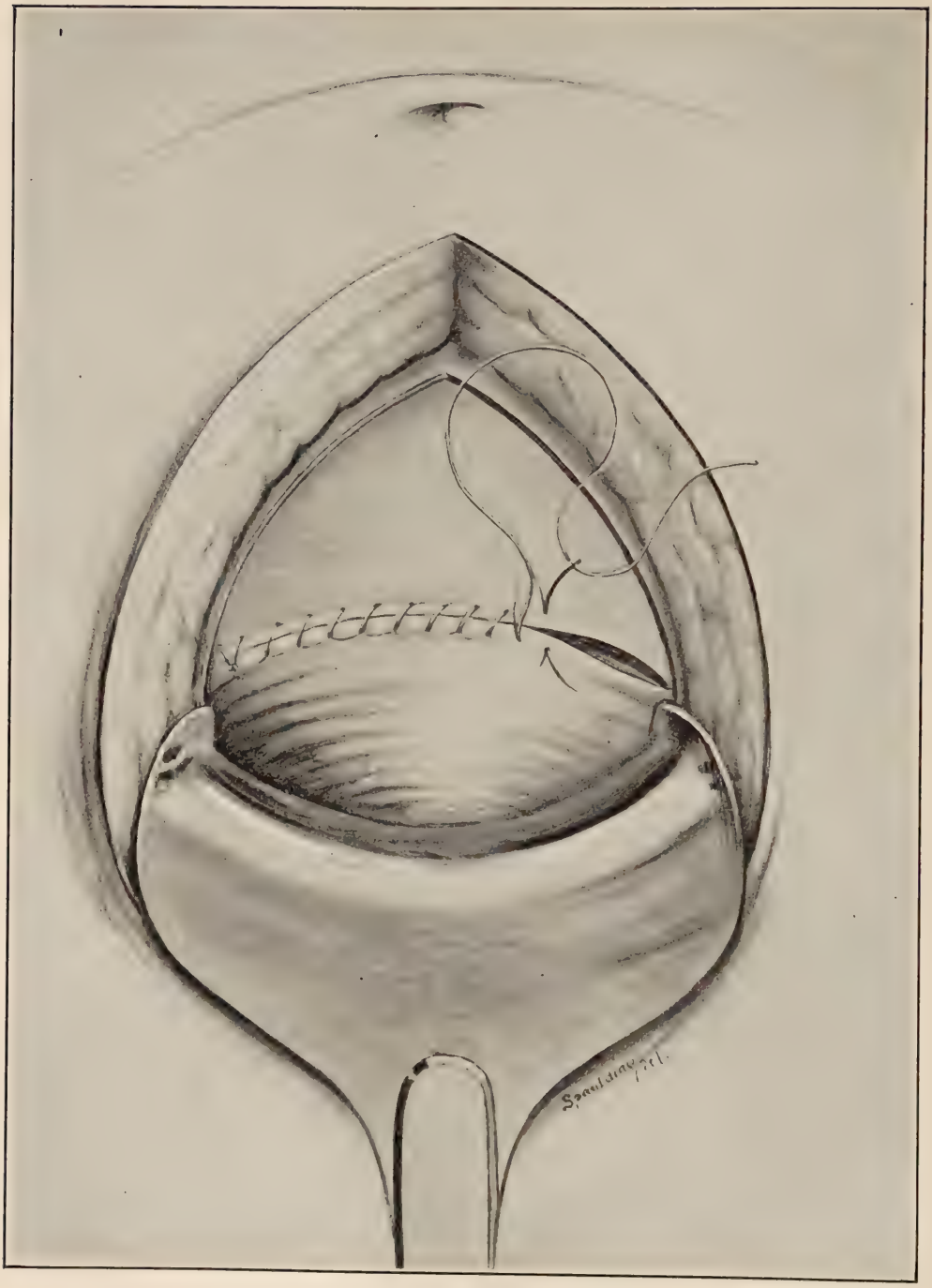

FIG. 14.—LOW CESAREAN SECTION.

Transverse cervical incision. The operation is completed by uniting the flaps of peritoneum, upper and lower, with a continuous suture of fine chromic catgut. The cervical incision is now retrovesical or subperitoneal.

1. Lesions of the heart, lungs and kidneys.
2. Toxemia of pregnancy in the presence of impending convulsions and in gravidæ who did not improve under the conservative treatment.
3. Pernicious vomiting of pregnancy in a gravida who is dehydrated and exhausted and who would not stand a long labor.
4. Premature separation of the normally inserted placenta in its milder forms.

Vaginal cesarean section is but seldom done at the full term of pregnancy, because of the greater difficulties in technic, because of the danger of the incisions tearing in the peritoneal cavity and because of the danger of injuring the bladder on account of the large size of the child.

Before attempting vaginal hysterotomy certain requirements are essential. The tissues must not be edematous or friable. The uterus must be movable so that the cervix may be readily brought down into the vagina. The pelvis must be ample. The child must not be too large. In the absence of these requisites, the vaginal cesarean section should not be considered, regardless of the indication.

Technic of Operation.—A weighted speculum is introduced in the vagina to expose the cervix. The cervix is brought down by means of two volsella, one at each lateral angle, and dilated with Hegar dilators to assure drainage. A suture of chromic catgut is placed at each lateral angle of the cervix and left long. These sutures facilitate the bringing down of the cervix after delivery. If the cervix is not readily brought down by this method, a No. 4 Voorhees bag is introduced in the uterus; it is filled with 1 per cent lysol solution, and used as a tractor. A transverse incision is made in the anterior vaginal wall at the point of attachment of the bladder to the cervix, and the bladder, together with the vaginal wall, is dissected upwards to the reflection of the anterior peritoneal culdesac. The bladder is never separated from the vaginal wall, as is illustrated in most textbooks, as this has been found to be unnecessary and because it predisposes to bleeding and injury to the hyperemic and friable vaginal wall.

The bladder is now held under the symphysis by means of a wide retractor, and the anterior lip of the cervix is incised up to the vesico-uterine culdesac, care being taken not to enter the peritoneal cavity. The posterior lip of the cervix is pulled upwards toward the symphysis, with volsella or the bag, as the case may be, and a transverse incision is made at the junction of the vagina and the cervix. The posterior culdesac and the rectum are reflected downwards, and the posterior lip is incised as far up as possible, care being taken to respect the abdominal cavity.

The instruments are now removed and the hand is introduced in the uterus, an internal podalic version and a breech extraction are performed in the usual way and the placenta and membranes are extracted manually. By injecting pituitary extract and an aseptic preparation of ergot, the bleeding is usually controlled so that packing is rarely necessary.

The cervical incisions are closed with interrupted sutures of No. 2 chromic

catgut: The vaginal incisions are sutured in the same manner with the same material.

When the fetus is small it is not necessary to incise the cervix posteriorly, as the anterior incision usually gives enough room for its extraction.

Indications.—At the fortieth annual meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, held at Asheville, North Carolina, September, 1927, Phaneuf presented his personal statistics on 27 vaginal cesarean sections in a paper entitled, "The Place of Vaginal Cesarean Section in Obstetrics." Anterior cervical incisions were made in 12 patients, and anterior and posterior incisions in 15.

The indications for the 27 operations were the following:

Toxemia of pregnancy (convulsive type)	6
Toxemia of pregnancy (non-convulsive type)	5
Toxemia of pregnancy (pernicious vomiting type)	3
Toxemia of pregnancy (ablatio placentæ)	2
Toxemia of pregnancy (pyometra; rigid cervix)	1
Toxemia of pregnancy (previous nephrectomy; retained macerated fetus; eighth month of pregnancy)	1
Chronic nephritis and pregnancy	1
Pulmonary tuberculosis (advanced)	1
Mitral stenosis and regurgitation; pyelitis	1
Congenital pulmonary stenosis	1
Hydramnion; rigid cervix	1
Rigid cervix; long labor	2
Pyelitis	1
Attempts at delivery before admission for hemorrhage (6½ months of pregnancy; dead fetus; contracted uterus)	1
TOTAL	27

One mother died, a maternal mortality of 3.7 per cent. She was a tertigravida, who, in her first pregnancy, had been delivered by a classical cesarean section for uterine apoplexy, and spontaneous incomplete rupture of the uterus. Her second pregnancy was terminated by a low cervical abdominal cesarean section. Her third pregnancy had reached full term, although her uterus corresponded in size with a five months gestation. On admission she showed signs of toxemia; she had developed uterine hemorrhages and a septic purpura. As she was failing rapidly, it was thought that her only chance rested in emptying her uterus. This was done by vaginal cesarean section. Pyometra was found to be present, a half a liter of foul pus being evacuated from the uterus as well as a macerated, five-month fetus. There was no difficulty with the operation, which was rapid. The patient was returned to her bed in poor physical condition. She died three hours later from shock, toxemia and severe uterine infection.

Twenty-four of the infants did not survive, a total fetal mortality of 88 per cent. If we excluded 9 macerated and 8 stillborn children the corrected fetal mortality was 37 per cent. Naturally these infants were markedly pre-

mature and toxic. The 26 mothers who recovered were free from complications, save one. In this case a vesicovaginal fistula developed. This is almost closed at the present time, but it may necessitate operative interference later if nature does not close it entirely.

Three women had pelvic deliveries following vaginal cesarean section. Two had normal deliveries, and a third had a version and extraction, and subsequently a normal delivery.

The reviewer concluded his paper as follows:

1. Vaginal cesarean section is a useful operation when an indication for immediate delivery arises in a gravida with a long, rigid, undilated cervix, up to the end of the eighth month of gestation.

2. The operation may be done at term, as shown by one of the cases of this series; but here the difficulties are greater, and there is danger of the incisions tearing in the peritoneal cavity because of the large size of the child.

3. A previous low cervical cesarean section complicates the technic of the operation since the anterior peritoneal culdesac has been obliterated. This may predispose to injury to the bladder during delivery.

4. Since the operation is extraperitoneal, postoperative complications are negligible.

5. The puerperium, as a whole, resembles that of any operative pelvic delivery.

6. The low transperitoneal abdominal cervical cesarean section which offers nearly as much protection against infection as does the vaginal hysterotomy, has displaced the latter operation in a number of clinics because of its simpler technic.

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PELVIC INFLAMMATION IN WOMEN

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Since the publication of the monograph on *Pelvic Inflammation in Women* many notable contributions have been added to the literature; the trend of these is toward more intelligent conservatism in the selection of operations and toward greater understanding of the value of the stimulation of nature's biologic resistant forces in combating infection.

Gynecic surgeons are becoming less radical as they more fully appreciate the successive barriers which are erected by nature in defense against bacterial invasion—for in the last analysis, infection of every type and in every location is nothing but a battle between the body and the invading organism. A victory of the former which is spoken of as recovery always leaves its scar in the form of permanent pathology.

Gonorrhea.—Gonorrhea and its consequences come in for considerable discussion, and notwithstanding the accepted bacteriological fact that the gonococcus must have moisture or a moist field in which to live and dies when exposed to dry air. The dry treatment mentioned in our previous appendix has in this country had little support (probably because of the detail necessary for its success). New chemicals as mercurochrome, acriflavin, and other aniline dyes have been generally employed. *All are agreed that the woman with an acute gonorrheal vaginitis should be treated in bed and kept at rest* in the Fowler position to favor drainage until the acute symptoms have subsided. Aside from rest and postural drainage the keystone of treatment is local cleanliness. This may be accomplished by alkaline flushings with the labia separated. During this stage of active purulent discharge *the vaginal douche is not only unnecessary but harmful.* The urinary output may be increased by the copious exhibition of alkaline waters. Not until all of the acute symptoms have subsided, is topical treatment admissible. It is at this stage that so much is claimed for mercurochrome (220) but here again, attention to detail is necessary for success. After the vulva is cleansed the patient is placed in the Sims or in the knee-chest posture and the perineum retracted with the Sims speculum; which opens the vagina and allows the entrance of air to separate the vaginal walls which permits detailed inspection of the infected areas. The vaginal mucous membrane is then wiped dry with pledgets of sterilized cotton and a 10 per cent solution of mercurochrome applied with a

nasal spray to every portion of the cervical and vaginal mucosa. After allowing the vaginal walls to dry, the application is repeated and the vagina is lightly packed with sterile gauze saturated with a 2 per cent solution of mercurochrome. This pack is allowed to remain *in situ* for twelve hours and the treatment is repeated the next day. Results have shown that there is a prompt disappearance of gonococci from the vaginal discharge. Instead of the vaginal pack the entire canal may be filled with a 2 per cent mercurochrome ointment; this is easily applied through a Ferguson tubular speculum. The excellent results obtained by Dorne and Stein in the treatment of gonorrheal vulvovaginitis in children by the daily injection of the vagina with a 1 per cent mercurochrome ointment, suggested that this form of topical application would have some virtue in the adult. Experience has justified its adoption.

H. W. Martin (*Med. J. & Rec.*, Feb. 1926) has obtained excellent results with acriflavin solution in strengths of 1 : 500 to 1 : 1000. The technic of the treatment is as follows: With the hips of the patient well elevated on pillows, 25 c.c. of a 1 : 500 solution is slowly injected into the vagina with a Day syringe. The woman retains the solution by remaining in the elevated hip posture for half an hour or more, thus allowing it to exert its antibactericidal effect by contact with the vaginal mucosa. This treatment, however, does not reach the tubular glands in the floor of the urethra (Skene's glands), Bartholin's ducts or the racemose glands of the cervix. The former with their latent infection are now recognized to be the most common source of reinfection; while the latter, after becoming chronic, terminate in a cystic cervicitis which furnishes a symptom-complex evidenced by persistent mucopurulent discharge and pre- and post-menstrual metrorrhagia. The dyes, unlike the silver solutions, have the power of penetrating the superficial layers of epithelium and are not rendered inert by the cervical and vaginal secretions. Vaginal infection is speedily controlled by either of these measures but the latent foci in Skene's tubules and in the glands of the cervix are more intractable. The former are the most common cause of reinfection as well as the chief factor in keeping up the vaginal discharge. The presence of these infected glands in the floor of the urethra may be demonstrated on inspection by making forward pressure upon the urethra just behind the meatus with a finger which has been introduced into the vagina, and milking the tubules of their infective content. The orifices are revealed by the escape of two drops of pus which may be seen coming from the mouths of these ducts one on either side of the median line.

Treatment.—When the diagnosis is made the cure is prompt and certain. A pledget of sterile cotton wet with a 10 per cent solution of cocain is placed in the urethra just within the meatus; while another pledget moistened with the same solution is laid against the meatal orifice. In about five minutes the anesthesia is complete and the fine point of a cold electric cautery may be passed into the tubule. The current is then turned on and the tubule destroyed by cutting upward into the lumen of the urethra—*but one tubule should be destroyed at a time.* An interval of about two weeks should elapse before the same procedure is repeated upon the opposite gland. Electric coagulation has

been employed for this purpose, but in our hands has not proven as reliable as the electric cautery when used with the foregoing technic.

Endocervicitis is now generally recognized to be the chief cause of sterility in the female, while its importance in the causation of abortion should not be underestimated. Furthermore, chronic erosions occurring on the portio of the non-lacerated cervix and upon the everted lips of the torn cervix become a source of chronic irritation and hence a precursor of cervical cancer (Bonney). It is usually the mucopurulent discharge or the excess of ropy mucus which causes the woman to seek relief from the physician.

Acute cervicitis and endocervicitis are always a part of any acute inflammatory process which involves the genitalia whether it be of neisserian or puerperal origin. When the infection reaches and involves the racemose glands of the cervix, owing to defective drainage it becomes chronic and intractable and neither douching or local treatment will do more than aid nature in the reparative process which ultimately terminates in a cystic cervicitis, stroma, hypertrophy and varying degrees of lateral and posterior parametritis. Hence, it is obvious that the condition should be relieved before actual tissue pathology takes place. A superficial erosion with its overgrowth of lymphoid tissue which does not involve the deeper structures of the endocervix is readily cured by linear cauterization with the fine point of an electric cautery. The lines of incision should radiate from the canal as a center, usually four incisions are necessary. In the course of three or four weeks due to the retraction of the endocervical mucosa the cervical lips are inverted and the erosion cured. Such happy results, however, cannot be secured when the infection has reached and involved the deeper structures. It is in this class of cases that the advocates of electrocoagulation are most enthusiastic.

Mikels, in *Surgery, Gynecology and Obstetrics,* July, 1926, states that electrocoagulation is the most conservative method of treating inflammatory lesions in the region of the cervix, and is the greatest safeguard against secondary malignancies. Even in extensive chronic lesions it is an adequate substitute for surgical enucleation, for it is not followed by the formation of inelastic scar tissue, which may either tear or obstruct at parturition. Furthermore, the intense heat generated in the tissues has powerful properties.

Technic.—After all of the acute symptoms have subsided the mucus and mucopus are cleared away by the application of the peroxid paste (referred to in the chapter on endocervicitis) and the external os and lower end of the canal sterilized with iodized phenol. The cervical electrode is then introduced to the internal os and the current turned on; a heat of 110° F. is maintained for about twenty minutes. This destroys the gonococci and empties the glands of the infected mucus. Many claim permanent cures by this method. *Our own experience, however, has not been in accord with this claim.* All erosions should receive immediate therapeutic attention, but clinically, the only erosions which are seen at a time when linear cauterization or electrocoagulation can relieve them are the postpartum erosions observed in the follow-up routine a month or two after delivery. The majority of patients do not present themselves for treatment until the chronicity of the disease has been

fully established. When this has taken place, destruction or ablation of the glandular structures are the only means by which we can hope to effect a cure. Destruction may be accomplished by deep cauterization with a heavy electrode with the patient under analgesia or anesthesia. To do this properly the most perfect asepsis must obtain. The cervix should be dilated with Hagar's dilators and when a diameter of slightly more than 10 Mm. is attained, the tip of a heavy cautery knife ½ cm. wide should be passed into the canal to a point just below the internal os, and four parallel linear incisions of about ⅛ inch in depth made along the endocervix. This leaves parallel strips of the cervical mucosa between the lines of cautery incision and preserves the patency of the canal. The Post cautery defeats this purpose, for when the tip is introduced into the canal the entire circumference of the endocervical mucosa is cauterized and varying degrees of atresia will result. When hypertrophy and cystic degeneration have occurred, tracheloplasty or amputation are generally necessary. The latter militates against pregnancy as it removes the cervix from its position in the seminal lake, and when pregnancy does occur, increases the incidence of abortion or premature labor—this cannot be said of a properly performed tracheloplasty. The cavity of the uterus, on the other hand, is lined with tubular glands, which under the stimulus of uterine contraction and the resulting venous stasis thus induced, pour out an excess of alkaline mucus and establish several lines of cellular defense against bacterial invasion. This is an admitted clinical fact which has been confirmed by experimental study by both American and foreign observers. Thus pathogenic bacteria are destroyed or barred entrance through the uterine wall by the formation of a leukocytic zone which is developed by maintaining firm contraction of the uterus. This in turn produces venous stasis, tissue edema, cell migration and frequently cell proliferation. This physiological protection is not found when the endometrium is not intact, for trauma, whether it be the result of the curet, sound, or digital exploration, opens avenues of entrance for bacterial inoculation. Hence, again *we warn the reader against the use of the curet in the presence of any form of infection whether it be acute or chronic.* When the infection passes through the uterus and reaches the tubes the character of the invading organism has a definite relation to the resulting pathology. Thus acute gonorrheal infection always results in bilateral endosalpingitis, though one tube may be more seriously affected than the other. In contrast, infections of puerperal or operative origin are commonly associated with unilateral tubal inflammatory involvement. This may be of either the endotubal or peritubal structures; such infections are more likely to leave a healed pathology.

We had supposed that the treatment of gonorrheal salpingitis was not a debatable question, but recently Bourne (*J. Obst. & Gynæc. Brit. Emp.*, Vol. 33, No. 2, 1927) has advocated early operative treatment for severe cases of acute suppurative salpingitis. He states that the operation of choice is salpingostomy, but that care should be taken not to leave a fallopian tube which can obviously never perform its function. He further calls attention to the persistence of coexisting gonorrheal infection in the uterus, cervix and urethra, and advocates that the uterine infection should be treated by frequent injec-

tions of glycerin and protargol, before antigonococcic measures are used to free the urethra and cervix of gonococci. His material, however, is so limited and his follow-up records so discouraging that we feel that his position should be mentioned *only to be condemned,* for to-day, all writers and teachers emphasize the fact *there is no surgical treatment for acute salpingitis.*

Curtis has proven (*Surg., Obst. & Gynec.,* 1921, 33) by a pathological and histological study of over 200 pairs of thoroughly ground fallopian tubes that it is impossible to obtain the gonococcus from the tubes longer than two weeks after the disappearance of the fever and leukocytosis. The constancy of this finding suggests that gonorrheal salpingitis is essentially a self-limited process, and that persistent active gonorrhea of the fallopian tubes should heal spontaneously. This, clinical observers have found to be the case, and operations have been almost entirely discontinued for the purpose of eradication of infections of the fallopian tubes; for nature's tissue reactions are more capable of doing this. Surgery, therefore, is reserved for such sequelæ of the disease as *painful adherent displacements, adhesions with symptoms, sterility and excessive menstruation.* Operation in the acute stage leads to unwarranted radicalism, unnecessary drainage, increased morbidity and mortality, and defeats rather than favors tissue conservation. Rest, time, milk injections, sexual abstinence and the temporary suspension of the menstrual function by arresting ovulation with the x-ray, will secure a satisfactory clinical result in the large majority of cases. No local treatment such as topical applications to the cervix or uterine mucosa is permissible.

Our follow-up records show that by employing such a plan of treatment as outlined above that pregnancy can and does occur in cured gonorrheal infection of the tubes in a small proportion of cases, and that this form of sterility may be relieved by operation relatively more frequently than in former years. Surgical interference solely for the relief of sterility appears permissible if desired by the patient, provided that the husband is healthy and potent, and the wife has demonstrated occluded fallopian tubes, a relatively healthy cervix and no palpable masses in the region of the adnexa.

Curtis calls attention to certain characteristics of gonorrheal lesions with their bearing upon operative procedure:

1. Adhesions of gonorrheal origin are amenable to separation by blunt dissection with the scissors.

2. Extensive denuded areas are avoided as blunt dissection usually permits smooth separation along natural lines of cleavage.

3. A single attack of salpingitis seldom results in marked permanent increase in the wall of the fallopian tube; such a lesion permits conservatism. Greatly thickened tubes encountered in patients who have recovered from infection are almost pathognomonic evidence of repeated salpingitis; they occur chiefly in prostitutes and in women whose husbands are carriers of infection.

4. Smoothly healed hydrosalpinges of moderate size which cannot be removed without the creation of a large raw surface or perhaps the sacrifice

of a healthy ovary, may be left *in situ,* for we know that viable gonococci are no longer present in them.

5. When after complete healing of salpingitis of moderate severity tubal occlusion is noted in which cicatricial contraction of the serosa produces infolding of the fimbria into the lumen of the tube, a process which is essentially a counterpart of a purse-string closure, the abdominal ostium may be reopened by gentle blunt dissection and the invaginated fimbria restored. Many cases of sterility due to tubal occlusion may be cured in this way.

6. *Ovarian conservation should be practiced whenever possible.*

A careful consideration of the etiology of the pelvic infection has much to do in determining the disposition of a doubtful ovary.

Gonococci do not live long in the tissues of the upper pelvis; streptococci, on the other hand, remain viable for an indefinite time, in fact, for years; therefore, in the presence of a diseased ovary with indications for removal somewhat uncertain, more radical surgery seems indicated in streptococcic infections than in gonorrheal disease of equal severity, because persistently viable streptococci predispose to postoperative ovarian infection. On the other hand, in patients operated for the relief of tubal and peritoneal lesions produced by the gonococcus, preservation of the ovaries should be the rule unless they are badly crippled. It must be remembered that the so-called "chronic cases" with repeated exacerbation are actually reinfections, a recurrence rather than a continuance of the infective process usually resulting from cohabitation with infected carriers or the traumatism of sexual intercourse—*hence, prolonged sexual abstinence favors spontaneous cure.* Chronic gonorrheal endocervicitis and bartholinitis have been considered intractable, requiring destruction of the gland structures or removal of the infected areas, for the local application of antigonococcics fails to reach the infected foci. Recently, Loeser of Berlin has claimed results from the injection of a single subcutaneous dose of live gonococci. He considers chronic gonorrhea in the female to be a latent infection representing a chronic infection of the lymph glands and lymphatic chains. It is in this type of case that vaccine therapy has been employed with varying success, only to be supplanted by more radical measures. Loeser takes the pus from a case of acute gonorrhea and makes a pure culture on ascitic blood agar (half and half). It is important that the gonococci be isolated quickly and be passed back into the human body after but twenty-four to forty-eight hours growth on the artificial medium. The germs grown in this manner on ascitic blood agar, form in a long serpentine line, and may be washed off in 3 c.c. of sterile physiologic salt solution; from ½ to 1 c.c. of this suspension, is taken up in an aseptic syringe and injected subcutaneously in the upper arm. With but one puncture two or three wheals can be produced. There are approximately ten thousand millions of gonococci in one slanting agar tube, so that between two and four thousand millions are contained in one hypodermic injection. Experience shows that the exact quantity is of minor importance so long as the number of injected germs does not sink below *one* or rise above eight thousand millions. Within twenty-four

hours a flaming red erythema develops at the point of injection surrounded by a "doughy infiltration." The area becomes painful but without any swelling of the regional lymph glands. A lymphadenitis or lymphangitis never develops. There is usually a slight rise of temperature, rarely reaching 38° C. The patient complains of headache which can be prevented by the preliminary administration of aspirin. Within twenty-four hours after the injection the erythema begins to fade and all clinical symptoms have disappeared. Similar injections can be made as well in the skin of the back, if this region seems more desirable. Only the truly chronic cases are suitable for this treatment, but if the case is properly selected, complete disappearance of all gonococci is usually achieved in from eight to fourteen days after the injection. Of 118 gonorrheal patients previously unsuccessfully treated, 68 or approximately 60 per cent recovered after a single injection. Surely such results justify a clinical trial.

Vaccines have had periods of disrepute, yet must be accepted as adjuncts in our treatment of chronic Neisser infections. To get a really good result from their administration it is necessary to have a vaccine freshly made from organisms of a vigorous strain. The best vaccine for a chronic gonorrhea contains gonococci and secondary organisms combined, the usual mixed vaccine consisting of gonococci, streptococci, staphylococci and diphtheroid bacilli. The first dose for a woman in average health should be from twenty-four to forty millions, depending on her body weight. This dosage is given once a week; after a week, if the patient has not had a reaction, the dose may be doubled. A reaction is indicated by rise in temperature and pulse rate from six to twenty-four hours after the injection; by sickness, headache or backache or by a feeling of general malaise. Should the reaction be but slight, the increase should be 50 per cent added to the previous dosage. On the other hand, if the reaction is severe, the original dosage may be repeated *but not increased*. Marked improvement should be noted after eight or ten injections. The treatment should then be suspended for two months when another series of injections are given.

A further demonstration of the trend toward conservation in treatment of adnexitis is shown by the manner in which the x-ray treatment has been received in some of the European clinics. Schoenholz (*Zentralbl. f. Gynäk.*, Sept. 18, 1926) states that there are three types of such treatment available:

1. Roentgen castration
2. Temporary castration
3. Shorter irradiations which are not associated with amenorrhea

Acute or subacute septic conditions of puerperal, postoperative or postabortal origin contra-indicate the use of x-rays, as radiation will activate the inflammatory process. This, however, is not so in gonorrheal or tuberculous infections, as temporary castration, controlling as it does the periodic occurrence of pelvic congestion, so diminishes the arterial blood supply that tissue resistance is increased and the gonococcus and tuberculous bacillus are eradicated or incapsulated.

Schoenholz claims 50 per cent of cures from temporary castration in tuberculous salpingitis. Certainly such a record should encourage us to give the x-ray used in this way further trial. In our own experience in gonorrheal salpingitis, we have found, in dealing with so-called reinfections occurring near the menstrual period or after coitus, that by the production of an artificial amenorrhea which would last from three to six months, absorption of the inflammatory products was favored, and in several of the cases so treated the symptomatic cure has remained permanent. We have not as yet operated on any of these cases in which temporary castration has been tried, hence the resulting living pathology cannot be described. Suffice it to say that the production of artificial amenorrhea favors pelvic resolution when the infection is of gonorrheal or tuberculous origin.

Protein Therapy in Pelvic Infections.—Protein therapy as an aid in the cure of pelvic infections has been more or less generally adopted in America. Since the original article by Gellhorn in 1922, this plan of treatment has received general indorsement. Milk injections have practically replaced all other forms of foreign proteins; the simplicity of the treatment as well as the results obtained have attracted the attention of many gynecologists. The initial dose is 5 c.c.; the following doses may be increased to 10 c.c. The injections are given into the gluteal region with a long needle and should be made deep and repeated at intervals of from three to five days, according to the clinical improvement and the severity of the reaction. As a rule a general reaction follows the first injection in five or six hours; a mild chill with moderate fever is the rule. However, the temperature may rise to 104° or more. The leukocyte count is increased to 20,000 or 30,000. *The special indication* for this treatment is a gonorrheal infection of the fallopian tubes after the first acute symptoms have subsided. It has also been used and with some success in tuberculous salpingitis, and in the exudative type of puerperal infection. It has no effect on blood stream infections. Many of the claims of Gellhorn, Pike, Duke and other enthusiasts have been sustained, yet we have never seen a tubal abscess disappear.

Diathermy.—The favorable results of diathermy in pelvic infections reported by Corbus and Cherry deserve some mention. These observers claim that diathermy is probably the most satisfactory available agent for the conservative treatment of pelvic infections due to the gonococcus. It relieves pain, diminishes the pelvic masses and aids in the complete resolution of exudates. Used as a preoperative therapeutic measure it will eliminate many of the technical difficulties in the removal of large pelvic masses and therefore contributes a smoother convalescence; and incidentally, the percentage of postoperative wound infections is thereby lessened.

The question naturally arises as to how these results are obtained. What effect will the prolonged maintenance of heat have on large pyosalpinges or on a tubo-ovarian abscess? Cherry assumed that if a penetration of the diseased structure by heat of 42° C. could be obtained the causal agent would be destroyed with an incidental reduction of the inflammation, and, furthermore, that the active hyperemia produced would aid in the rapid absorption

of the products of infection and should promote resolution. Acting upon this assumption, 100 patients with adnexal disease were treated at the Harlem Hospital with diathermy. In all of these patients the gonococcus was a causal factor. This was determined by positive urethral or cervical smears, confirmed by the clinical picture of concomitant urethritis, endocervicitis, skenitis or bartholinitis. The degree of pelvic involvement varied from small, thickened, tender adnexa to large pus-tubes or tubo-ovarian abscesses that entirely filled the pelvis. There were 27 patients who presented large pelvic or abdominopelvic masses. There were 23 women without masses whose adnexa were thickened and tender. The abdominovaginal application was found to be the most practicable. This consisted of placing an abdominal electrode above the pubis in contact with the skin and a vaginal electrode through which a thermometer was inserted, with the exposed surface placed behind the cervix in contact with the vaginal vault. Sufficient current was utilized to raise the vaginal temperature to from 42° to 43° C. (1500 to 2500 Ma.). When the current was stabilized, the temperature was maintained from fifteen to thirty minutes, the treatment being repeated at from three- to five-day intervals. The most striking feature resulting from the application was the almost instant relief of pain. Among the 77 cases with pelvic masses, 41.5 per cent showed a marked diminution in size. Complete disappearance was more apt to occur in those cases having the initial attack. Of these 77 patients, 49 were entirely relieved of symptoms, making operation unnecessary or making the patient so comfortable that she refused surgical intervention.

Puerperal Infection.—Between five and ten thousand women die annually in the United States from puerperal infection—a sad commentary on American obstetrics. Many of these women would probably have recovered had their delivery been left to the natural powers; but physicians are too apt to interfere in their efforts to shorten the course of normal labor with the result that the maternal tissues are traumatized and tissue resistance is lowered. As I stated in the beginning of this review, infection is nothing but a battle between the body, the body fluids and the invading organism. All treatment, therefore, should be supportive.

Along this line, Hoffbauer has suggested that, in addition to giving small repeated blood transfusions, there should be a routine use of small doses of pituitary extract. Pituitary extract stimulates the great reticular endothelial system of the body and favors the production of special defensive cells which may be found at the time of delivery in the parametria of all pregnant women. These are increased in number by pituitary stimulation and offer an added defense against bacterial invasion. Certainly this drug can do no harm and may have the effect which Hoffbauer claims for it.

Descarpentiers has treated 63 cases of puerperal fever with injections of the patient's own hemolyzed blood. This method of treatment for childbed sepsis, as far as I know, has not been used in this country, though sensitized blood has been utilized in the treatment of acute rheumatic fever.

At the suggestion of Goodall, we have employed intramuscular blood injections in the treatment of infections. These have acted as protein therapy,

causing some systemic reaction and a temporary increase in the leukocytic defense. It is difficult to conceive how hemolyzed blood injected intramuscularly can have a very different effect from that experienced from the use of the injections referred to. However, it adds another therapeutic measure to our resources, and surely we need them all.

Antistreptococcus serum is another remedy which has its enthusiastic supporters, but it has not proved its dependability. It is routine in many institutions to use the serum in all septic cases, hence, many cures are attributed to it which in reality would have occurred without its use. In blood-stream infections it has signally failed. My impression is that its greatest value is in producing immunity; this would necessitate its employment before the infection occurred and this, of course, would subject a number of patients to a needless reaction.

Since 1920 the *intravenous injection of mercurochrome* has had a fair and extensive trial all over the country. The suggestion of using mercurochrome as an intravenous injection in bacteriemia was first brought out by Piper and subsequently popularized by Hugh Young. This method has been used in all types of severe blood-stream infection. It would seem like an elusive dream to suppose that by injecting a bactericidal solution into the vein that we could hope to kill all the bacteria circulating in the blood. Furthermore, if there are no bacteria, but only their toxins, it is even more difficult to see how such treatment can be of benefit. Experience has taught us and this is substantiated by experimental studies on animals that mercurochrome does not destroy streptococci without doing such damage to the maternal organs as to render them less able to function. St. George (*J. Am. M. Ass.*, 1925, 85:2005) reported the necropsy findings in 5 cases which had been studied by the chief medical examiner's deparment of the City of New York. In all 5, mercurochrome had been administered intravenously according to the detailed directions of Piper and Young. Postmortem examination revealed both macroscopic and microscopic changes in the liver, the spleen, the kidneys and intestines, such as necrosis in the liver and spleen, ulcerated exudative colitis, acute parenchymatous nephritis with ulcers of the intestines. There was a striking similarity in the lesions found in the kidney and the colon. Chemical analysis of all of the viscera showed even larger amounts of mercury than are usually found in mercuric chlorid poisoning. Certainly, with these findings in view, one can hardly recommend or indorse the use of mercurochrome which is certain to add its toxic effect to already maimed organs.

Puerperal infections develop from the inoculation of cervical tears with their consecutive parametritis and from endometritis which is soon followed by a myometritis and a thrombophlebitis. From these local lesions bacteriemia may supervene. It is important, therefore, that the infection be confined to a local focus in its early stages. This is done primarily by the tissue defense, which in turn is stimulated by maintaining firm contraction of the uterus and, later, by stimulation of the blood structures of the body by transfusion. The cellular reactions in the broad ligament, the periuterine conservative plastic exudate, the lymphatic blockings, the leukocytic wall and the area of

small round infiltration found in infective endometritis underlying the necrotic desquamating endometrium and thrombi in the uterine veins offer a series of first, second, and third line defenses. If nature is competent to develop these defenses the woman gets well because the infection is localized. However, if as the result of hemorrhage, trauma, toxemia or general ill health these defenses are not developed, bacteriemia develops.

The question, therefore, naturally arises: Can surgery help by the removal of the septic focus, that is, by the removal of the uterus or by ligation of the efferent veins? In answer to this query, we can say that J. F. Baldwin, of Columbus, Ohio, stands to-day as the only advocate of hysterectomy in puerperal thrombophlebitis. His technical skill and his diagnostic acumen explain his success. Again, he operates early, and must therefore necessarily remove uteri from women who would have recovered without such radicalism.

In conclusion, it may be said that surgery of puerperal sepsis is limited to the removal of perineal sutures, the incision and drainage of localized abscesses and stab wound drainage in spreading peritonitis. These incisions are best done under local anesthesia.

PELVIC NEOPLASMS

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In the three years which have elapsed since the publication of the manuscript on *Pelvic Neoplasms,* there has accumulated a very considerable literature. While most of it is centered about carcinoma of the uterus, and the relative values of Roentgen ray, radium, and surgery, as therapeutic agents, there have been many contributions on other subjects of such value as to warrant this cursory review of the literature. See also page 368.

BENIGN TUMORS OF THE OUTLET

Fibroma of the Vulva.—Most of the literature on this subject is confined to case reports and no one has attempted a review comparable to the splendid contribution which Leonard made in 1917. Ferguson,[1] in 1924, described a tumor which had developed in two years from the left labium into a pendulous growth 2 feet 2 inches long, and with a diameter of 3 inches at the lower pole. It proved to be a telangiectatic fibroma. It falls in the first group of Leonard's classification and appears to have arisen shortly after a fall two years before. The patient had had an operation for uterine fibroids five years previously. The large myxoma of the labium majus, reported by Fisher, in 1919, is pictured in Taussig's monograph, *Diseases of the Vulva,* in this series. Fullerton,[2] in February, 1925, describes a fibroid in the vestibule. Tumors in this location are rarely seen. In Leonard's comprehensive review of 131 cases, there were only 5 tumors in this location. Attwenger,[3] in 1923, describes a fibroma of the clitoris which grew completely in only seven weeks. The tumor was pear-shaped; dissection proved that it rose from the caput clitoris.

Taussig,[4] who has made so many valuable contributions to the pathology of the vulva, in 1923 described an angioma which developed from a congenital nevus. Most of the hemangiomata have been found in children, yet even they are very rare.

Lipoma of the Vulva.—Lovelace,[5] in 1923, reported a lipoma which originated from the left labium. It hung down to the patient's knees like an

apron, weighed 44 pounds and was said to have developed in three and one-half years. The patient was 5 feet 6 inches tall, and weighed 200 pounds. The photograph, which will be found on page 125 of Taussig's monograph of this series, does not show the origin as given by the author, but looks like a lipoma which has arisen from the fat of the lower abdominal wall. Lipomata of the abdominal wall often stretch out and have a rather broad thin pedicle, although they usually arise in the abdomen higher than shown in the illustration. Lovelace, however, is conversant with the large lipomata of the lower abdominal wall, since he alludes to the case of Christopherson in 1906, in which an Arab of about 65 years had such a fatty tumor in the lower abdomen, the skin hanging down from the umbilicus to the middle of the thigh like a bag, enclosing a mass of fat and becoming continuous behind with the abdominal skin again over the pubis. If the tumor of Lovelace is really vulval and not as it appears in the photograph, it is very much larger than any other case on record, since there is reason to believe that the Balls-Headley tumor quoted in our text as 24 pounds weighed in reality only 2 pounds. This tumor is quoted in the literature usually as 21 pounds. The tumor of Steigele has been quoted as 101 pounds. We accepted it as 10 pounds. The errors in the literature occurred because of the peculiar character of type used in printing the Balls-Headley article in the *Australian Medical Journal* in 1888, in which the characters for the letter "l" and the figure "1" are identical, and because there was no spacing between the numerals and the symbols "lbs." Lovelace reviews the literature of fatty tumors of the vulva and finds 45 cases.

Sweat-Glands of the Vulva.—Schellekens,[6] in 1923, describes a case of this rare tumor, which proved to be an adenoma, situated in the left labia of a woman of 39.

MALIGNANT TUMORS OF THE OUTLET

Carcinoma of the Vulva.—Taussig [7] has covered so completely this subject in his monograph in this series that there is little to add at the present time. The newer literature consists of case reports, many of which are only citations in discussions in gynecologic societies. For the most part, they record experiences with radium or the Roentgen ray, while others urge the very close relationship between leukoplakia and the cancer and insist upon treatment of leukoplakia on the basis of its being a precancerous condition.

Our review of the subject promotes a profound pessimism as to the present day curability of the usual run of vulval carcinoma since the disease occurs usually in the old and feeble, who seek treatment only when the growth is far advanced.

There is no doubt but that radical surgery will cure selected cases. This is well proved by Taussig's report in 1923. Three of his 9 cases treated by *radical* surgery remained well for more than five years. One was lost track of after two years when she was free of recurrence. Taussig's review proves his belief that *radical surgery will cure more than 30 per cent of the cases operated*, provided a radical lymph gland dissection is done coincident with the wide removal

of the primary growth. Yet surgery as usually performed is not radical and rarely, if ever, cures, and it is an open question whether it is worth while, if the general profession continues to treat these growths. The pessimistic view of the condition given in our texts is based upon reports from university clinics, where presumably surgery was more radical than in general hands.

Our individual observations convince us that cancer of the vulva, although comparatively rare, occurs far more frequently than is evidenced by the litera-

Fig. 1.—Huge Lipoma of Vulva

(Lovelace, *J. Am. M. Ass.*)

ture. Moreover, it is treated usually by general practitioners whose therapy consists of simple excision, which rarely offers any chance of cure. Since the prognosis of carcinoma of the vulva is sufficiently gloomy, even after a *radical* dissection, and the simple excision is not even palliative, we believe a sentiment should be created to discredit strongly any but truly radical surgical procedures and to advocate those only after the tumor region and the groin have been rayed either by radium or the modern Roentgen ray

Furthermore, we believe that the majority of cases will be treated equally successfully by the modern Roentgen ray and by radium, either alone or in combination. Since the appearance of the text, the modern Roentgen ray has come to occupy a definite field in the therapy of malignant tumors, and far

surpasses even the most favorable results obtained by the older machines. The value of radium treatment is well established and there are several reports of five-year cures. A number of observers have used radium emanations in fine gold needles known as "bare tubes," each tube containing 0.5 mc. or 1 mc. buried at least 1 cm. in depth and 0.5-1 cm. apart. The method is illustrated in Taussig's monograph. We have had good local results in this manner but without cures, because the cases had marked inguinal involvement. Several writers record their experiences with radium but have not followed their cases sufficiently long to talk of cure. Bailey and Bagg,[8] in 1921, recorded 10 cancers of the vulva treated by a combination of radium and surgery. The tumors were first treated with massive doses of radium, after which the lymphatics of the groin were dissected out and the wound was needled with a number of bare tubes each containing 0.5 mc. radium element placed 0.5 cm. apart. Keene,[6] in a discussion of Bailey and Bagg's paper, alludes to 19 malignant tumors of the vulva or vagina which were treated by radium in the gynecological service of the University of Pennsylvania. Seventeen were carcinomata and two were chorionepitheliomata. The cases as vulval or vaginal growths were not separated. All were radiated. The two chorionepithelioma were alive and well five and six years after treatment. Four of the 17 other cases were known to have survived, one for one and a half years, one for two and a half years, one for three years, and one between five and six years. E. Zweifel,[10] in 1922, reported 29 cases of vulval carcinoma treated in the University Clinic in Munich by radium. One case was symptom-free seven years after the treatment. Schmitz,[11] in 1924, cites a vulval carcinoma cured for five years by radium.

While the procedure of Bailey and Bagg cannot be duplicated by many men, since it involves an enormous amount of radium, there are enough modern Roentgen ray machines scattered through nearly every town to warrant treatment by the gamma ray. Radium, moreover, is nearly universally employed in the United States and even 100 Mg. of the radium element will suffice for treatment.

Carcinoma of the Female Urethra.—Carcinoma of the female urethra may be primary or secondary. It is a rare disease, although there is no doubt that it occurs much more often than is indicated in the literature. Many men, however, of extensive experience may have seen only two or three cases. Ehrendorfer, in 1899, quoted 27 cases. Yet O'Neil,[12] in 1921, was able to collect but 68 cases and Venot and Parcelier, later in the same year, reviewed only 87 cases. Keene, in 1921, mentioned 6 cases seen in the Gynecologic Clinic of the University of Pennsylvania. Since then Pomeroy, O'Conor, and several others have described individual cases. We have seen only one case in a series of nearly 400 pelvic cancers.

The primary tumor may arise from the mucous membrane of the urethra or from Littré's or Skene's glands. It often arises from a chronic inflammatory area; more rarely from a caruncle. There are two major types: The polypoid or everting, and the ulcerative or infiltrating form. Beginning usually in the canal near the external orifice, the tumor tends to grow outward since the structure of the urethra resists invasion for a considerable

time. The growth, therefore, soon appears at the external meatus where it spreads to the surrounding tissues. The appearance of the tumor varies considerably accordingly as the carcinoma is or is not superimposed upon a preëxisting infection. The tumors arising from infected areas are usually of a slower type of growth than those which are frankly carcinomatous from the start. The tumor may be of squamous cell or of cylindrical cell epithelium. It metastasizes through the lymphatics along both the anterior and posterior surface of the pubis to the glands in the groin or the pelvis. Many have called attention to the late involvement of glands. Venot and Parcelier [13] found that they were not enlarged or appeared grossly normal in two-thirds of cases.

The secondary carcinoma of the urethra is usually a metastasis from a cancer of the uterus.

The disease may be mistaken for an ulcerative infiltrating erosion of syphilis from which it can be differentiated by the presence of spirochetes or by biopsy. The Wassermann reaction may give a clew. The superficial vestibular urethral form of carcinoma may also be confused with tuberculosis, although the latter usually presents a more even surface without the same tendency to infiltration. An ulcerating fibroid of the urethra may also be confused with carcinoma, although the former is more isolated and can be readily shelled out of its capsule. Older writers urge biopsy since there has been much difficulty in distinguishing the transition of the simple adenoma into the malignant adenocarcinoma. The suggestion is rational only if it can be done by diathermy or the cautery knife.

Radium appears the most likely method of treatment at the present time although there are very few cases reported in the literature. Shaw,[16] in 1923, reported 2 cases well three years after radium. Schmitz,[11] in December, 1924, reported 2 out of 5 five-year cures. Radium did not help our case, a woman of 54, with rather advanced growth, who died within the year. Surgical procedures have removed the urethra even to within 1 cm. of the neck of the bladder and dissected out the lymphatics on both sides of the symphysis. It does not seem a reasonable method if the growth is advanced, since the patient is likely to lose urinary control, when the operation merely adds to her suffering. Only 2 of Ehrendorfer's 27 cases were free from recurrence as long as three years. The majority of cases succumbed within a year, although R. Peterson had one which survived for five years and Vineberg one three years without relapse. O'Conor,[15] in 1924, reported a case treated by diathermy and radium. The local cure was perfect although the ultimate prognosis was hopeless because of extensive glandular involvement.

The urinary control remained good even in advanced cases of the disease. The literature abounds with cases retaining urinary control even after extensive surgical procedures. When radium is inserted in the urethra, the greatest care must be taken to hold it in place. The same holds for plaques which are applied locally to the growth. We have seen a case where a burn followed displacement of the radium capsules.

Carcinoma of Bartholin Gland.—This tumor is undoubtedly rare, yet the literature does not properly express the frequency, since vulval growths are usually seen by men in general practice who do not report them and who may be content merely with their removal. Falls,[17] in 1923, reviews the cases of this rare tumor, collecting 17, only 3 of which were in America. The cases were nearly equally divided between squamous cell epithelioma and adenocarcinoma. Falls' case was treated by radical surgery, radium, and Roentgen ray and remained without recurrence for fourteen months thereafter, when the case was reported. Casler, in the discussion of Falls' case, alludes to an unreported adenocarcinoma seen in Kelly's clinic in the Johns Hopkins Hospital. The patient entered because of a prolapse of the uterus, at which time a small tumor about the size of the end of a thumb was found in the labia. Treatment consisted merely in excision, since it was not believed to be malignant until the routine laboratory examination. The patient remains alive and perfectly well sixteen years later, probably because the growth was so early that it had created neither symptoms nor metastasis, a condition that is seldom duplicated.

Casler also alludes to a papillary cystadenoma which showed malignant changes in several places. The case was also seen in the Johns Hopkins Clinic. Falls' cases were limited to primary growths. Pfeiffer,[18] in 1923, described a secondary cancer in the Bartholin gland, a metastasis from a cancer primary in the uterus. Pfeiffer records this as the second case of the kind on record.

Sarcoma of the Vulva.—R. Veit,[19] in 1924, reported a non-pigmented sarcoma of the vulva which originated, he believed, either in the supporting tissue of the Bartholin gland, or from the connective-tissue stroma. He found in the literature only 2 other cases of similar origin, one recorded by Hofmeier in 1920 and the other by A. Bluhm in 1904. His review suggests that there are only about 50 cases recorded of non-pigmented sarcoma. The only one which began during pregnancy was described by Neuwirth in 1917. It began in the third month but the patient did not die until two years later. Veit's case was treated with surgery combined with the modern Roentgen ray. The result is not known since the case was followed only for eight months, at which time there was no recurrence. Casler, in the discussion of Falls' paper on carcinoma of the Bartholin gland, alludes to a sarcoma of the Bartholin gland seen in Kelly's clinic in the Johns Hopkins Hospital.

MALIGNANT TUMORS OF THE VAGINA

Carcinoma of the Vagina.—There are a number of individual case reports in the literature of this rare tumor, although no systematic review is attempted. Bailey and Bagg, in 1921, reported 18 cases, all of which were treated by radium. The tumors were all primary with two exceptions. There is no discussion as to cure, since the longest period of observation was but two years. Stacy,[20] in 1922, records 21 cases treated by radium. The cases were not followed long enough to permit of discussion as to cure. It is of interest, however, to find that 14 of the 21 cases had some follow-up record.

Seven lived for periods varying from five months to nearly four years; of the 7 which died, one lived two years and four months and 2 others for more than a year.

Keene, in 1921, urges the greatest care in radiating carcinoma of the rectovaginal septum since fistulæ very frequently result. This distressing complication occurred in 3 of the 17 carcinomata of the vagina or vulva treated in Clark's clinic in the University of Pennsylvania. Fistulæ of the rectovaginal septum occur more frequently than in the bladder wall. While fistulæ often follow radiation, it is well to recall that they are often seen as a direct result of extension of the disease. Even with the possibility of fistula formation, treatment with radium is a logical procedure. Surgery certainly creates greater complications and deformities. Because of the chance of distressing sequelæ, it seems logical at present to urge that cases with this dread disease be sent to men well versed in the radium treatment so that they may treat the growth locally with radium and spray the pelvis with the modern Roentgen ray for metastasis. It seems logical also to urge the needling of the local tumor with tubes of radium emanation, each of 1 mc. placed 1 cm. apart.

Sarcoma of the Vagina.—Dellepiane,[21] in 1924, reported a spindle-celled sarcoma of the vagina found in a nulliparous woman of 21 years of age. She had been married two years. Symptoms had occurred for six months and consisted in painful micturition and bloody vaginal discharge. A nodular, somewhat necrotic mass extended well into the posterior vaginal wall and infiltrated adjacent tisues. The cervix was not involved. The case was treated with the modern Roentgen ray with local and subjective improvement for the seven months during which the case was under observation.

BENIGN TUMORS OF THE UTERUS

Lipoma of Uterus.—Schleussner[22] reports a case which he cites as the seventeenth lipomatous tumor on record. Four occurred as cervical polyps, his and 12 others were tumors of the body of the uterus. His and 6 others are simple lipoma. The other 10 are lipomyoma.

Adenomyoma.—*Frequency.*—There were 211 adenomyomata in 3388 fibroids reported from the Mayo Clinic, 6.43 per cent. There were 5 cases in the fallopian tubes.

Etiology.—The theory of Cullen that adenomyomata were extensions of uterine mucosa into fibroid tissue for a long time served to explain this great group of tumors. The mucosa functioned as uterine mucosa, gave decidual reactions in pregnancy, and secreted blood during menstruation. The extensions of the endometrium were also proved by serial sections in 55 of 56 tumors. The theory appeared to lack only a reason for the mucosal infiltration. This defect was presently supplied by von Franqué, Legueu, Marie, and others who saw it as a result of chronic inflammation. Others believed that it was closely dependent upon the changes incidental to gestation. The limitations of the theory became evident only with the recognition of the "ectopic" adeno-

myoma. While it accounted satisfactorily for the uterine tumors, it failed to account for the ectopic adenomyoma of the pelvis, such as adenomyoma of the ovary, or those in the pockets of the pelvis as on the uterosacral ligaments, or the tumors of the rectovaginal septum.

The theory of von Recklinghausen also had some supporters. It advanced the view that adenomyoma of the uterus sprang from fetal rests of wolffian origin, a belief built purely on theory and not susceptible of proof. It accounted satisfactorily for the adenomyoma in the uterine horns but failed to explain tumors in other locations. Many argued against it on the ground that it was illogical. Some claimed, as R. Meyer, that the tubules have no resemblance to the wolffian duct or any of its derivatives, while others argued that the embryonic areas never came close enough together to account for the tumor in adult life.

Admitting the possibility of the theory, it was soon found that other explanations could account equally well even for the tumors near the horns. Von Franqué demonstrated that epithelial infiltration was a frequent finding in chronic salpingitis of tuberculous type. Lubarsch, in 1902, and R. Meyer, in 1903, found that this phenomenon is not limited to tuberculous salpingitis but could occur with any tubal inflammation.

This inflammatory theory soon took on wider proportions. The cause of the epithelial proliferation was taken as a preëxistent inflammation. Granulation tissue, areas of round-cell infiltration, and proliferating connective tissues were all held to be permeable to a benign epithelial infiltration. The proliferation of the epithelium was interpreted as a reaction to aid in the repair of damage done by the inflammation. Meyer used the term epithelial heterotopy to characterize the non-malignant invasion of the epithelial membrane. He felt that any epithelial structure could take on this function in the presence of inflammation. Orth had described a similar process about the suppurative follicles in amebic dysentery. Ziegler had described the same condition in abscess of the bowel. Richter had found like processes in ileocecal ulcers in tuberculosis. The theory now advocated chiefly by Meyer explained satisfactorily, as did Cullen's, the intra-uterine adenomyoma.

Meyer explained ectopic adenomyoma by the theory that Ivanoff advocated in 1898 to account for adenomyoma. Ivanoff believed that the glandular structures were derived from the peritoneal serosa by the process of metaplasia. Under the stimulus of inflammation, the peritoneal epithelium proliferates and sends down bands of cell-buds into the subjacent tissue. These proliferate and form branching tubular processes, the cells of which become indistinguishable from columnar epithelium derived from true mucous membrane. The connective tissue changes its character and becomes the cytogenous tissue so characteristic of the adenoma.

Meyer believes all adenomyomata arise on an inflammatory base and the epithelial structures are inclusions of proliferation from either uterine mucosa or peritoneal serosa. The fact that the mucosa takes on decidual changes, Meyer holds, does not controvert the theory, since the decidual reaction is no longer held characteristic only of müllerian tissue. It occurs in inflam-

matory processes of omentum, appendix, and retroperitoneal tissue in the culdesac.

Sampson [23] has recently developed a theory which explains more simply the origin of ectopic adenomyoma. He has developed it from a remarkable series of histologic studies. He sees the tumors as results of implantation and transplantation of epithelium rather than of metaplasia.

Sampson believes that ectopic adenomyomata arise from epithelial cells which escape from the abdominal end of the open fallopian tubes during the menstrual process and which become embedded subsequently upon the pelvic peritoneum, either as a primary process or after the tissue has developed in the ovary which acts as an intermediate host. In marked contrast to Meyer, who saw the tumor as an inflammatory reaction subsequently invaded by epithelium, Sampson sees the tumor as a proliferation of epithelium, so irritating to the contiguous structures that an inflammation develops about it as a protective reaction. The theory is obtaining wide acceptance.

Sampson's work developed from a study of hemorrhagic cysts of the ovary, a condition found in 10 per cent of women between the ages of 30 and the menopause whom he operated by the abdominal route for the relief of pelvic pain. The cysts are usually bilateral and small, measuring from 2 to 4 cm. in diameter. The ovaries are adherent, and when freed, a chocolate-colored fluid escapes which is characteristic of the condition. Sampson was early struck by the marked relationship between these chocolate cysts and adenomyoma. His study soon suggested that epithelial cells escaping from the fimbriated ends of the tube during menstruation became adherent upon the contiguous ovary, and maintained the ability to proliferate. When the ovarian follicle developed and burst, the cyst cavity was invaded by these proliferating epithelial cells which soon formed a lining. A section taken from the depth of the hematoma usually showed lutein cells; the cyst from the perforation is more or less completely relined by the endometrial implants which develop on the surface of the ovary. This epithelium retains both its former structure and function. It forms structures resembling uterine glands; stroma soon appears, resembling that of the endometrium, lying between the epithelium and the ovarian tissue. The stroma varies in thickness, is usually vascular and may be thin or almost lacking. The gland spaces frequently contain old or recent blood, exactly resembling the hematomata in adenomyoma of the uterus believed to be retained menstrual blood. The histological findings varied in different specimens and in different portions of the tumor. They correspond to the cellular picture seen in the various phases of the menstrual cycle.

Exact counterparts of the epithelial structures seen in these ovarian hematomata can be found in other parts of the pelvis. They often look more like normal endometrium than do the structures seen in the ovary. Histological study shows that the hemorrhage is periodic and into closed cysts or pockets, as occurs in uterine hematoma of uterine adenomyoma. Sampson believes that the epithelial cells or their secretion are highly irritating to the peritoneum and that they quickly form adhesions. The ovary invaded by these cysts usually is densely adherent and chocolate colored. Dark blood may escape

from the adhesions as the ovary is freed. Microscopic adenomyomata of the endothelial type occur in the adhesions. Sampson believes that many times in the life of the ovary, displaced epithelial tissue escapes into the peritoneal cavity after rupture of the follicle, and gravitates to some pocket in the folds of the pelvis. The resultant mass may remain small and quiescent or become invasive. Thus, it may cause adenomyoma by invading the uterine wall or adenomyoma of the round ligament if this structure is attacked, or adenomyoma of the sigmoid colon, etc. There is discussion as to just how the contents of the chocolate cyst stimulate the development of adenomyoma. The disease seems to spread as do implantations of ovarian papilloma, or carcinoma, on the peritoneal surface of the pelvis after rupture of the primary ovarian tumor. While Sampson insists that the chocolate cysts of the ovary are often the first step in the production of ectopic pelvic adenomyoma, he does not claim that it is the only method of production. Thus, it is possible theoretically for the epithelium escaping from the tube during menstruation to become transplanted directly upon the pelvic peritoneum and, as a result of proliferation, produce adenomyoma of the rectovaginal septum.

There has been no change in the treatment of ectopic adenomyoma since the appearance of the text. A number of observers record their experience with radium. In some cases, as in that of Herly,[24] the growth developed again after a quiescent period. The adenomyoma of the rectovaginal septum may remain long dormant. We have a case under observation where it has been quiescent for five years after hysterectomy. There are several new reported cases of adenocarcinoma in adenomyoma of the rectovaginal septum.

FIBROIDS

Fibroids and Sterility.—It has long been known that fibroids are often seen in sterile women. In the 3617 fibroid cases which Lynch collected from the literature in 1913, 31.5 per cent were sterile. In his individual series of 215 fibroids in women married three or more years, 31.8 per cent were sterile. A similar compilation showed that sterility in married women in general ranged somewhere between 8 per cent and 15 per cent. That is to say, there is more than twice as much sterility in fibroid cases as in married women in general.

There are three ways to explain the relation between fibroids and sterility: (1) The fibroid causes sterility; (2) sterility causes or at least favors the fibroid; or (3) there is a common factor which favors both the fibroid and sterility.

1. Does the fibroid cause sterility? There are many statistics in the literature tending to prove that the fibroid causes sterility by reason of its presence, and that the larger the tumor, the more likely is sterility. The statistics of Schorler, Young, and Williams, and Goetze may be rearranged to support this view. In Goetze's series, the percentage of sterility ranged from 13.6 per cent in cases in which the fibroid was the size of an apple to 50 per cent in cases with growths the size of a man's head or bigger. The larger tumors may favor sterility by causing disturbances in the uterine circulation which create

discharges which lessen the likelihood of conception, or, by changes in the endometrium, interfere with the embedding of the egg. Yet pregnancy is often seen in the presence of very large tumors. Nearly any physician of experience can recall pregnancies associated with fibroids the size of four, five, or even six months pregnancy. In fact, pregnancies with fibroids are common enough to have created a considerable literature. They are rarely seen with submucous fibroids in which hemorrhage is a predominant symptom. In this connection, one should recall that pregnancy occasionally occurs in other conditions associated with marked leukorrhea. It may occur with carcinoma of the cervix, even when leukorrhea and bleeding have been symptoms.

It, therefore, appears that fibroids often cause sterility. Yet, in this discussion we must recall that fibroids usually develop comparatively late in a woman's menstrual life, whereas marriage and pregnancy ordinarily occur early. Between marriage and the time when the fibroid has attained a size or created conditions favoring sterility, the woman might have had many children, unless there was some other factor which was responsible for sterility.

This view is supported by the fact that nearly all women who have submucous fibroids have borne children. Goetze found that 91 per cent of his submucous fibroids had had children. Eighty per cent of the submucous cases of our own series were also parous. The submucous fibroid usually originates in the puerperium, being the result of a displacement of the interstitial growth during retraction and involution of the uterus after labor.

The above indicates that sterility from fibroids may be due only to changes resulting from the position of the tumor, the presence of leukorrheal or sanguineous discharges, or because of circulatory or degenerative changes in the tumor. In an individual series of 215 fibroid cases of women married three years or more, Lynch [25] found that only 169 had been pregnant, a sterility of 31.8 per cent. It seems difficult to believe that the tumor *per se* was responsible for the sterility in this series because the growths, for the most part, were only a few centimeters in size. Even in Goetze's series of large tumors, sterility was present in only 50 per cent.

2. Does sterility cause fibroids? The affirmative of this question has been argued for years, ever since Stephen Bayle, in 1807, wrote on the question. In this discussion, we should divide our cases into virgins and non-virgins. It is argued that fibroids are common in virgins, because the uterus has been denied its opportunity to hypertrophy in its physiologic manner, *i.e.*, pregnancy. This view was advanced by Bayle and has received warm support from many men who do surgery of the celibate woman of religious orders in whom fibroids are undoubtedly common. The view is interesting but does not yet admit of proof since there are no large series of accurate observations concerning the pelvic organs of virgin women. It may be urged with equal right that there are unduly large proportions of women with underdeveloped rather than overdeveloped pelvic organs in the religious orders and that fibroids are frequent in uteri that are immature. More is known concerning the frequency of fibroids in married women who seek relief for sterility. Tubal inflammation is the common cause of sterility. If sterility *per se* favored fibroid

development, we should see many fibroids associated with old inflammatory disease of pyogenic origin. Yet the fibroid incidence is not great in these conditions.

3. There is a common factor favoring both sterility and fibroid development. In a study of uterine retroversions and retroflexions following delivery, Lynch found that the women who had had posterior uterine displacements of congenital origin were less likely to become pregnant than those whose uterus was in normal position prior to pregnancy, suggesting that the sterility in retrodisplacements is largely due to congenital causes. Study of sterility and fibroids also strongly suggests that sterility long antedated the fibroid. Data from the retroflexion studies suggest that there is a common origin for both the sterility and the fibroid. In this connection, it is worth while to recall that Bayle, in 1807, wrote that fibroids, while common in virgins, were also frequently found in married women who were sterile. The first part of the statement alone seems to have made an impression on the literature. We believe that the literature warrants the belief that both fibroids and sterility (in the absence of known causes) are due to some congenital condition expressing itself clinically as lack of uterine development.

Pregnancy after Radiation.—It has long been known that pregnancy following radiation was likely to result in monstrosities. This view dates to 1903 when Bohn described deformities in frogs resulting from radiation of the embryos. Gilman and Baetjer in the same year reported their observations from raying fertilized ova of amblystoma. They found a characteristic deformity in the head and brain. Hartwig in more recent time has done a tremendous amount of work along these lines, making observations after raying spermatozoa, non-impregnated ova and impregnated ova. He worked with the semen of frogs, the eggs of seagulls and of a number of nematodes. Since then Baldwin, Bagg, Little and Bagg, and a great number of others have worked with experimental animals, and described deformities resulting from radiation, the most common being in the eyes and brain. The observations of Lacassagne and Coutard, in 1923, are of considerable interest. These observers found that the progeny of female rabbits that had been previously radiated were less resistant than normal in that there was more "infant mortality" in the cases that had been radiated than in the normal controls. Arrested development was also frequently noted in the embryos found in the tubes at time of autopsy. Others have shown that the same distressing results were likely to follow no matter whether the female animal was rayed before fertilization or during pregnancy.

The literature affords abundant evidence that the fibroid should not be treated with radium or Roentgen ray during pregnancy, although there are a number of cases reported in which the fetus has shown little or no injury. Yet the literature offers no criterion as to what dose can be safely borne during pregnancy without resultant fetal injury. The fact that there are deformities is positive and should be carefully considered. Aschenheim, in 1920, reported a case in which treatment had been given between the second and sixth months of gestation. The child was premature at eight months, was microcephalic, had deficiencies of sight and was an imbecile. Stettner, in 1921, reported a fibroid

that had been treated with Roentgen ray when the woman was two months pregnant, the condition not being known. An underdeveloped child was born at eight months with hypospadius, strabismus, neuroretinitis, and definite mental changes. The child could not speak at 2 years of age. Aschenheim's case was treated with rays evidently of the short wave type, while Stettner's case was probably of the deep therapy type, the dosage being considerable in each. Lawson,[26] in 1925, reports the Roentgen ray treatment of a fibroid in a woman pregnant four months. The child was delivered by a cesarean section somewhat before term, and remained mentally and physically backward for two years before developing normally. On the contrary, there are several reported cases where women during pregnancy were treated with radium for uterine vaginal cancers without causing known deformity in the child. Such cases have been reported by Berkeley in 1921, Field in 1922, and Bailey and Bagg, 2 cases in 1923. The method, however, cannot be considered safe.

There is also some literature concerning pregnancy following some time after pelvic radiation. Werner,[27] in 1921, showed that radiation of the pelves of adult women does not necessarily inhibit the power of conception, predispose to abortion or premature labor, disturb parturition, or cause monstrosities. He studied 24 cases that were known to have followed a series of 1542 cases that had been radiated for benign hemorrhages, 552 of which were fibroids. Thirteen cases came to term with normal living children, 9 aborted, one child was born four weeks premature, one pregnancy was terminated by the removal of a fibroid uterus which had started to grow again. Stacy,[28] in 1922, reviewed the pregnancies that were known to have followed cases that were radiated in the Mayo Clinic. The total number of women who had been radiated at time of her report was 1013. Pregnancy was known to have followed in 10 cases; 4 of the children were normal and born at term, 3 were stillborn, 2 cases aborted, and the tenth had not been delivered when the article was written. Clark and Keene reported their experience in 1922. They had radiated 527 cases. Seven women were known to have become subsequently pregnant. Only 2 of these were delivered at term of normal children. Steiger reports a case of pregnancy following a two-year period of amenorrhea. A normal child was born at term. Bailey and Bagg report 2 cases where women radiated during pregnancy in regions other than the pelvis were also delivered of deformed children. They also report 2 cases in which pregnancy followed radiation for fibroids. The first became pregnant nine months after treatment, and was delivered at term of a large stillborn child; the second became pregnant one and a half years after treatment and was delivered of a normal child at term. Pemberton, in *Surgery, Gynecology and Obstetrics,* in August, 1924, reported 4 pregnancies following some time after rather light radium treatments given by Graves in Boston. There was no deformity of the fetus. While these case reports present no complications other than stillbirths and abortions, Naujoks,[29] in December, 1923, reported a case in which there is clear proof of injury to the fetus because of radiation of the ovary before pregnancy. The dosage, however, was large.

Occurrence of Malignancy with Fibroids.—Essen-Moeller,[30] in 1921, reported malignancy in 22 of 700 fibroid cases, 6 cancers and 16 sarcomata. Mayo, in 1922, recorded that 4 per cent of his fibroids presented some evidence of malignancy. Vogt,[31] in 1923, in 1216 fibroids in the University of Pennsylvania, found 30 sarcomata. Eight of these could be traced directly to changes of the fibroid, 0.6 per cent. Ten sarcomata were early, 12 were moderately advanced, and 8 presented extensive involvement. That sarcoma is a dangerous condition is well shown by the results. Twenty-four had radical operation. There was a follow up of 16 cases with only 2 cures and 14 fatalities. Masson,[32] in 1923, reported sarcomatous changes in 44 of 4322 fibroid cases in the Mayo Clinic (1 per cent). Apparent cure was obtained in only 36 cases. Aschoff, in the same year, found that 1 per cent of the fibroids in the Freiburg Clinic had sarcomatous change. Reed and Charlton,[33] in 1923, reported 11 uterine sarcoma of which 9 developed in fibroids. Truesdale, in 1923, found 6 malignancies in 300 fibroids. Jeff Miller,[34] in 1924, reported 4 malignancies in 127 fibroids operated in New Orleans; 3 were carcinoma of the cervix and one fibrosarcoma. The Pennsylvania State Cancer Commission [35] in their 1924 report show that in 45 cancers of the uterine body, fibroids had been present before the malignancy in 7 cases.

Treatment of Fibroids.—There have been many articles on fibroids in the literature of the last few years dealing for the most part with therapy. The great majority emphasize that we have at our disposal three great therapeutic agents, the modern Roentgen ray, radium, and surgery, each of which has definite advantages and disadvantages. While the literature is largely composed of articles advocating one method to the exclusion of the others, there is no doubt that the truly conservative man will utilize all three.

As has been urged in the text, the treatment of fibroids should be divided into four headings, expectant treatment, Roentgen ray, radium, and operation.

Expectant Treatment.—The opinion is gaining ground, fortunately, that too many fibroids are subjected to treatment, and that a very large proportion of these tumors are relatively harmless. Lockyer concludes that 55 per cent give rise to no symptoms. There is little doubt that many small fibroids are actively treated largely because the practitioners are misled by the literature as to the frequency of complications from fibroid tumors. We have frequently urged that the fibroid literature in texts has been compiled from study of large tumors. The statistics of Noble, Deaver, and others, which expressed the condition of older times, no longer represent the frequency of serious complications in fibroids seen at the present time. Some indeed, as William Neil, Jr., in 1924, urge that uncomplicated tumors, even the size of a five months pregnancy, be let alone if they are not giving symptoms. The existence of a fibroid heart is again disputed by Winter.

The view of Neil represents the extreme and does not appear to us as a safe procedure unless the woman is near the menopause and the physicians at her disposal are comparatively unskilled in surgery, and especially not versed in gynecologic conditions. We have elsewhere alluded to the danger attending the use of emergency surgical methods in conditions which are chronic and not

immediately threatening life. Personally, we believe that any woman had better keep a tumor not yet giving symptoms even if it is the size of a five months pregnancy rather than be filled with a mass of intestinal adhesions resulting from an unskillful surgical operation, if she recovered. Nor is it safe to allow a tumor of such size to go untreated. Fibroids of much smaller size develop serious degenerations. Moreover, they may grow quickly. Recently we have seen a tumor in three years develop from the size of a large hickory nut to several masses larger than a man's fist, and compel operations because of degenerations. We are of the opinion that growing fibroids, even 4 or 5 cm. in diameter, may be treated in young women early by myomectomy rather than allowing them to grow to a size requiring hysterectomy.

There is no doubt but that fibroid tumors presenting symptoms represent serious conditions. Yearly we operate many cases which have bled so long that they cannot be safely operated without repeated blood transfusions. While deaths in untreated cases are seldom seen in the literature at the present time, Dartigues,[36] in 1923, is not alone in calling attention to the frequency of serious complications.

Roentgen Ray.—During the last few years, there has been a tremendous improvement in Roentgen-ray therapy. This is due in large part to the employment of rays of shorter wave-length than formerly used. The wave-length of these rays approximates those of radium. The newer tubes permit high voltage (200,000 to 280,000) delivered at the Roentgen-ray terminal. Proper screening will eliminate the rays of long wave-length (which do not penetrate deeply), and permit the raying of the deeper tissues with homogeneous rays which pass through the body tissues in a straight line with a negligible amount of reflection or refraction from contact with body cells.

Even before the improvements, striking results were frequently obtained in the treatment of fibroids whose chief symptom was hemorrhage. The defects of the older methods were their uncertainty and the number of burns which ensued. With the improved machines, the results are better in that amenorrhea can be produced in nearly all cases. The development of roentgenology has taken away treatment with the newer machines from the hands of the general practitioner since the rays are extremely powerful and capable of much harm, if unskillfully applied. This will probably diminish the number of burns. Yet there are other dangers. One must be extremely careful as to what tissues are radiated. Smithies, in 1924, reported a case dying from injury of the adrenals and Whipple has shown the frequency of intestinal burns.

The great defect of the treatment with fibroids is that results depend upon the induction of a menopause by the destruction of the ovarian follicles. Some claim that there is also a direct effect upon the tumor but it is a fact that little or nothing can be accomplished without producing amenorrhea. The treatment, therefore, is not adapted to persons in whom the retention of ovarian activity is desirable, which in our minds restricts it nearly completely to women about to enter the menopause. Roentgen-ray treatment of fibroids probably has a little wider field of usefulness than does radium since it may

be given to large tumors, to cases with old pelvic inflammatory disease of the adnexa and to submucous tumors without necessarily producing harm. Whether it accomplished much in these cases is still an open question. Seitz [37] and Wintz,[38] who are enthusiastic advocates of the method, claim it is the best treatment in cases where sarcoma is suspected in the fibroid mass, in which case they give doubly strong doses. Many others disagree. It is evident, of course, that in case there are benign degenerations of the fibroid, that Roentgen ray cannot cure, and that the logical treatment is surgical removal of the mass. It also would appear that if the rays did act upon the fibroid tissue to any considerable extent that Roentgen ray given to tumors with degenerations or submucous growths would be productive of harm exactly as occurs in radium. The treatment should not be given without preliminary curettage to exclude the chance of malignancy since adenocarcinoma of the fundus is not best treated with any method of radiation, although there is less agreement as to sarcoma. The seriousness of the modern method of Roentgen-ray treatment demands that the case be under the general direction of a gynecologist and not in that of the roentgenologist.

There is a long list of case reports in the literature of the last five or six years. Béclère,[39] in 1921, reported 300 cases treated with Roentgen ray. He claimed the reduction of the size of the tumor was so constant that an abdominal tumor diagnosed as uterine fibroid which does not shrink after Roentgen ray cannot be considered to be fibroid. The authors are not able to corroborate this opinion from their review of the literature. Gal, Krönig, and Gauss, in 1921, also strongly urged the wider employment of the Roentgen ray and feel that marked menorrhagia does not contra-indicate it. Essen-Moeller, in 1924, reported 103 fibroids treated by Roentgen ray, 32 of which were big enough to show above the superior strait. Fifty cases returned to normal size, 10 were reduced but not markedly, in 20 there was no change. Twenty-three were lost in the follow-up. Martindale, and Hanks,[40] in 1924, reported their results, the latter in a series of 100 cases. She prefers this therapy because in her judgment it is easier and safer than radium. She claims that it reduces large tumors more certainly and works more slowly, sometimes taking two or three months before the menopause is established, which gives the individual time for readjustment to meet the distressing condition. The latter point has not been noticed by us, since we find that hot flashes constitute an early complaint after the first treatment. Menopausal symptoms came on in ten days with Pirazzoli's two large tumors recorded in December, 1924. Gellhorn, in 1921, reviewed the literature and collected 2982 fibroid cases treated with Roentgen rays, with 95.6 per cent symptomatic cures and 4.4 per cent failures. Better results have been obtained in single series. Gauss and Friedrich had 98.4 per cent cures and 1.6 per cent failures in 425 cases treated with Roentgen ray. Gellhorn, however, feels that in selected cases radium is safer than the Roentgen ray.

Not all the reports are favorable, however, to this method of therapy. Nor would they be if the results accomplished are due to the destruction of ovarian function, a subject we reviewed in the text. Hempel-Jörgensen,[41]

in 1924, reviews 5 cases, all of which were treated unsuccessfully with the modern Roentgen ray. One case had had radium in addition. The tumors were submucous in 3 instances and intramural and subserous in the others. All came to operation. Hempel-Jörgensen reviews the list of men who advocated the Roentgen ray for submucous fibroids at that time, finding that Doederlein, Krönig, and others advocated it. Lundquist,[42] in 1922, reported a small series in which he contrasted the results obtained in modern Roentgen ray and radium. Thirty-four cases were treated with Roentgen ray. Amenorrhea was produced in 22, 7 cases were improved, and the treatment was unsuccessful in one. Forty-eight cases were treated with intra-uterine radium. Amenorrhea was produced in 26, improvement was noted in 7, and the treatment was unsuccessful in 15. Radium was applied vaginally only in 12 cases. Amenorrhea was produced in 5, the condition was improved in 6, and one was not improved. The tumors were reduced in size in between 75 per cent and 80 per cent of each series.

The question of dosage is of the greatest interest. The subject, however, is too complicated to be considered here, as it goes a long way into the realm of physics. The student, therefore, is referred to the modern bibliography of the Roentgen ray. There are, however, different ideas concerning dosage held by roentgenologists of different nationalities. The Germans still favor, as they did years ago, massive doses, believing that the reduction of the fibroid depends entirely upon castration and that this result is produced more certainly by one large dose. The French, on the other hand, believe in divided doses, which are given usually at weekly intervals. Some of the French authors feel that these also act upon the tumor and sterilize the follicular apparatus of the ovary just as effectively as if the massive dose were used. They claim that divided doses minimize the shock to the patient and prevent the reactions seen after a single heavy dose, even in the German clinics.

Evidence that the divided dosage is reasonable was adduced by Warren and Whipple,[43] in 1923. These investigators approached the question through animal experimentation. They found that the maximum sublethal dose applied to the abdomen caused the same amount of destruction in the animal's intestines no matter whether it is given in single doses, or in smaller doses if repeated within six-day intervals. On the other hand, they found that frequently doses given six days or more apart gave no evidence of summation. On the contrary, there was a suggestion that the tissues may have become more tolerant.

Radium.—Many have recorded their experiences with radium during the last two years and there is more agreement as to its indications and limitations. Keene,[44] writing in 1924, stated that it is not applicable to more than 50 per cent of cases and feels that it has definite contra-indications. While these are in essence identical with the text, we shall again give them. Radium should not be used in: (1) Tumors larger than a three months pregnancy; (2) rapidly growing tumors, for fear of sarcomatous change or preëxisting benign degenerations; (3) uncomplicated tumors of any size giving rise to symptoms other than abnormal menstruation; (4) tumors associated with pelvic pain; (5)

pedunculated tumors of any type; (6) tumors producing hemorrhage and complicated by demonstrable adnexal pathology; (7) when the bleeding from the tumor is not sufficient to explain a marked secondary anemia; (8) tumors in young women; (9) tumors so distorting the uterine cavity that the radium cannot be introduced well above the internal os; (10) in cases where the differentiation between fibroid and adnexal tumor cannot be definitely determined; (11) fibroids or myofibropathic hemorrhage in nervous women; (12) in cases of radiophobia. Nearly all agree with these postulates. Many have had bad experiences after radiating fibroid cases associated with unexplained anemias resulting from the absorption of toxic substances from degenerative areas. Nearly all agree that radium is not applicable for the routine treatment of submucous tumors.

Burnam [45] has treated successfully a number of comparatively large fibroids with radium, 30 of the tumors ranging between the size of a four and seven months pregnancy. He has used large doses of radium, which prohibits his method from universal adoption. Burnam feels that as far as bleeding is concerned radium is just as effectual in large tumors as in the smaller growths, although larger doses are required than in the smaller tumors. He uses at one time an intra-uterine carrier containing an emanation equivalent of 1½ grams of radium. By moving the carrier, he treats all areas of the uterine cavity and thus limits the chance of an excessive dose for any one place. He has given as much as 3 gram-hours radiation in the uterine cavity without bad effects. This treatment is augmented by radiating the pelvis through lateral portals over either ovary for a dosage of 10 gram-hours, which he believes has almost the same effect as the 1500 mc.-hour intra-uterine treatment. The radium is held a distance of 3 inches from the skin. External radiation in addition to the intra-uterine treatment appears to him as indispensable for large fibroids with short uterine cavities. The treatment requires about five hours for the full 20 gram-hour external dosage and should be done at two or more sittings. This is in contrast to the treatment of smaller growths in which the standard intra-uterine dose to produce permanent amenorrhea has been 1½ gram-hours, giving an amenorrhea of at least a year in nearly all cases and a permanent amenorrhea in about 80 per cent of cases. Burnam urges that each operator determine for himself what dosage is necessary for the treatment of his individual case since it is impossible to interpret the intra-uterine dosage on a gram-hour basis independent of the amount of radium used and the time consumed. In his 30 cases, Burnam found that the uterus returned to normal size in 15, to the size of a six weeks pregnancy in four, and did not grow again in any of the 19 cases. In 11, the reduction in size was unsatisfactory, although there was relief of symptoms.

Ward,[46] up to 1924, also had treated successfully 17 cases larger than a four months pregnancy. He had 14 satisfactory follow-ups. Eleven tumors were reduced in size, many to nearly normal. He had used comparatively small amounts of radium, giving from 1200 to 3600 Mg.-hours. Contra-indications to operation were present in all cases. Two of the cases had submucous growths and developed toxic absorption and finally sloughed consider-

able tissues. Although both recovered, the convalescence was attended by temperature and one case remained thirty days in the hospital, the other seventy-nine on account of the sloughing mass.

Bailey,[47] whose work with radium in gynecology is well known, does not care to treat fibroids greater than the size of a three months pregnancy with radium. He has had 9 large tumors up to 1924, 5 of which extended above navel. Of these 5, one was lost in the follow-up and possibly had a hysterectomy at another hospital. He was compelled to do hysterectomies on the other 4. The tumor of one was very edematous and larger than when he first saw it. Another was much smaller but was filled with degeneration areas. We have had one case larger than a four months pregnancy in which the symptom of profuse bleeding was arrested and the tumor itself returned to the size of a six weeks pregnancy in about six months. A disagreeable menopause was the only complication.

Faure [48] used comparatively small doses of radium, repeating the treatment if the results were unsatisfactory. Writing in 1921, he preferred radium but admitted that with improved Roentgen-ray machines the latter might be preferred. Clark, Lundquist and others emphasized the fact that radium in selected cases gives excellent results.

Personally we do not see a great field for the radium treatment of fibroids. Theoretically the treatment is logical but there are too many contra-indications. Practically, the treatment is applicable to certain small tumors in which hemorrhage is the cardinal symptom. Since radium acts chiefly upon the tumor and more slightly upon the ovary, this treatment is more logical than is the Roentgen ray if we agree that the retention of ovarian function is advisable. Practically, however, it is nearly impossible to treat the tumor successfully without affecting the ovaries. When comparatively small doses of radium have been given in the uterine cavity, the endometrium generally atrophies and no longer responds to the stimulation of the ovary. Endarteritis causes an occlusion of many smaller vessels and there is a change from myomatous to fibrous tissue resulting in shrinkage of the tumor and restriction of the bleeding. The theoretical advantage of radium over Roentgen ray is less marked if the tumor is large, since the feeling is crystallizing that destruction of ovarian follicle is necessary to ensure the marked reduction in the size of the tumor. Therefore, in large tumors, intra-uterine radiation should be supplemented by cross-fire through the abdomen with either Roentgen ray or radium. Practically the treatment of the smaller tumors is likely to cause permanent amenorrhea. Whether the future will prove that radiation of the pituitary gland will cause shrinkage of the fibroid tumor remains to be proved. The subject is under investigation.

The limitations of the treatment are real, and demand complete recognition. They concern both age of patient and condition of the tumor. There exists, moreover, a certain danger. The restrictions of age are based only upon the destruction of ovarian tissue and the precipitation of the menopause. For that reason, it is best suited for cases approaching the menopause and is not desirable for young women.

The fact that it will not cure submucous tumors demands careful consideration since growths of this type constitute a large proportion of the fibroids causing symptoms. Moreover, it is not always easy to diagnose submucous tumors prior to removal. We have radiated several tumors of three months pregnancy size or more in which it was finally found that in each case the hemorrhage was dependent upon a submucous tumor not larger than 4 or 5 cm. in diameter. All of these cases had been practically exsanguinated and were not good risks for operation. Radiation gave no results. After nearly three months wait, during which time patients had been repeatedly transfused, all finally came to operation. The frequency of degeneration in large tumors is well known. The larger the tumor, therefore, the more likely you are to encounter complications from absorption of toxic products resulting from degenerations. The treatment is not without danger because of the chance of lighting up a previous, but unsuspected, inflammation. One case of ours with a large tumor, the size of a five months pregnancy, a bad risk for operation, was hospitalized for more than three months from a peritonitis resulting from such a reaction. We had carefully examined her previously and had not been able to detect any sign of an old inflammation since she was fat and not easy to examine. Moreover, we have had a number of cases radiated by us develop extremely severe menopausal symptoms, and feel in consequence it is not a method well adapted for the treatment of nervous women.

There is no doubt but that atresia of the uterine canal has been a common sequel to intra-uterine radiation. The stricture is often followed by pyometra.

Operation.—This method of therapy should be considered in two sections, hysterectomy and myomectomy.

Hysterectomy.—From the practical standpoint of cure, hysterectomy far surpasses Roentgen ray or radium since with the removal of the entire uterus and tumor goes all fear of subsequent malignancy. The shortcomings of the method are that it is destructive. Moreover, there is risk of life, definite though small; much pain as a direct result of operation followed by a certain amount of semi-invalidism; and considerable monetary expense. Yet there is a broad field for hysterectomy and one which is undoubtedly permanent, in cases which are not suitable for radium or Roentgen ray, or where these measures have failed because the tumor has caused pressure or has degenerated and caused pain, or where malignancy, or marked inflammatory disease, or adenomyoma are complications. The uterus and tumor are usually removed by supravaginal hysterectomy. The one weak point of this procedure is that cancer may later supervene in a cervix which has been allowed to remain. Scattered case reports constantly appear in the literature. In 268 cervical cancer cases cited by the Pennsylvania State Cancer Commission in 1924,[35] there were 9 which developed in the cervix after supravaginal hysterectomy for fibroids. This suggests a need for panhysterectomy which we feel should be done wherever practical. In case it is not deemed wise, the cervix, if diseased, should be cored out from above if it has not been previously repaired just before the laparotomy. In our own experience, the mortality of panhysterectomy and supravaginal hysterectomy are practically identical. A hyster-

ectomy seems ideal in that the surgeon may leave the ovaries while removing the tumor mass and uterus. Occasionally, however, the ovaries later may become cystic because of disturbance of the ovarian circulation. The literature abounds in descriptions of methods which claim to permit removal of the uterus without interfering with the ovarian circulation. They fail since it is impossible to maintain the integrity of the utero-ovarian branches of the ovarian circulation after removal of the uterus. Fortunately, it makes comparatively little difference in the great mass of cases.

Myomectomy.—There is no doubt that myomectomy is increasing in popularity. The procedure is ideal in that it removes the offending structures, and disturbs the pelvic organs to a minimum degree. In our opinion, it is the treatment of the future. Yet at present it cannot be applied to all cases in active menstrual life since the tumors are often so large that myomectomy cannot be safely done. Moreover, it is not the operation of choice for men beginning surgery.

In the past, myomectomy has not been popular because the mortality as given in the text is higher than that of hysterectomy. We have many times emphasized that mortalities reported in surgical texts usually belong to an older era, and do not represent results in good hands at the present time. The proper technic of myomectomy involves much detail. It should be done by a technic evolved for the surgical treatment of chronic conditions and not that of emergency procedures. If the patient is left with large knots and rough surfaces placed to invite intestinal adhesions, the performance of myomectomy is a serious error. Roentgen ray or radium, or even supravaginal hysterectomy, would be more rational procedures.

When one has developed a proper technic for myomectomy, an enormous mass of tumor structures can be safely enucleated. The authors are much impressed with the frequent seriousness of menopausal symptoms, both following radiation and operation, and feel that in myomectomy there is a way of avoiding this distressing complication. By operating tumors which have begun to grow rapidly after considerable observation, myomectomy will come to prevent more radical measures.

Myomectomy may be used occasionally even in the face of hemorrhage since the results indicate that the bleeding in fibroids is not chiefly dependent upon ovarian activity. Recent confirmation of this belief was given by Schmid's [49] report, in 1923, of the follow-up of 88 myomectomies in the Prague Clinic. In case of doubt, the uterine cavity should be opened and carefully inspected before a definite type of operation is decided upon. The presence of pyometra contra-indicates myomectomy. In our opinion, myomectomy can be safely extended to women of 38 to 40 after exclusion of all evidence of malignancy, provided the uterine tissue permits good closure. We urge this because of the belief that an artificial menopause is a distinctly pathological situation. Ott, in 1924, among others asks why surgery should be delayed until the case is in a serious condition. Mayo, in 1922, reported 504 myomectomies with a mortality of 0.8 per cent. Giles, in the same year, advocates myomectomies up to the fortieth year. Bonney, in 1922, reported

100 cases with the removal of from 1 to 30 fibroids. If menorrhagia were the complaint, he opened the uterus to be sure all masses were removed. His complications consisted almost entirely of hemorrhage. There were 2 deaths, one from shock and one from hemorrhage. Five of the cases subsequently went through pregnancy.

Theoretically, the operation permits of subsequent conception, although care must be exhibited with each individual case. Gouillioud,[50] in 1924, reported 95 cases in which pregnancy occurred 125 times following myomectomy. One hundred went to term and resulted in living children. The series was marred by uterine rupture in 3 instances, one of which was fatal. This, in our judgment, is not necessarily an indictment against myomectomy, since we believe that all will come to agree that the closure in myomectomies presents the same problems as does that in cesareans, and that pregnancies following extensive myomectomy should be delivered by cesarean section before the onset of labor. There are, in addition to Gouillioud's report, a number of other small series of pregnancies following myomectomy recorded in the French literature.

MALIGNANT TUMORS OF THE UTERUS

Carcinoma of the Uterus.—*Etiology.*—The infection has received decided support through the work of Nuzum,[51] who in 1924 reported to the American Clinical Congress of Surgeons his studies of several years duration. From inoculation of dextrose ascitic fluid with fragments of an early carcinoma removed from the human breast, Nuzum has grown anaërobically a filtrable micrococcus which, when introduced into white mice and dogs, causes an epithelial tumor resembling carcinoma and which gives off metastases. From these tumors in the experimental animals, the same organism was obtained by inoculating dextrose ascitic fluid. The organism was injected into the leg of a man of 70, who apparently had been sensitized to carcinoma by having a cancer of the face. A tumor mass resulted which, when removed, gave the structure of an epithelioid cancer. The paper was printed in 1925. This work, although strikingly suggestive to the very highest degree, cannot be accepted as proof positive until it has been presented in complete form and has been confirmed by other independent investigators. We have stressed in the textbook the importance which we attach to heredity as one of the etiologic factors in cancer and have urged that the importance of heredity is not generally appreciated chiefly because family histories are not well taken in the usual hospital record. In our clinic, we carefully distinguish between patients in whom the family history is well known and those in whom it is not known. We do not count as family history any record in which the patient is not familiar with the causes of death of mother, father, grandparents, and some of the collaterals. We have been struck in our cases with the very high percentage of cancer in the family of cases in our series in which such data were known.

Little,[52] in 1923, also discussed the question from records in the Eugenic Record Office of the Carnegie Institution. This material had been furnished by persons of intelligence, conscientiously endeavoring to provide accurate

family histories for scientific purposes. His study showed that cancer occurs much more frequently in those in whom there is a family cancerous history than is to be expected from the general cancer mortality figures.

Writing in 1923, Gideon Wells [53] discussed the influence of heredity on the occurrence of cancer. Wells urged that "statistical evidence in literature of the present time may be dismissed with the statement that in the question of human cancer heredity, all existing statistical evidence is valueless for any exact information on this subject and must remain so until such time as we have necropsy records on all persons dying in several generations." He stated that "in considering the relationship of heredity to cancer even a single error in diagnosis might totally destroy the value of an entire family history making it appear that cancer was present in a branch of a family when it was not, or that it had failed to appear in a certain branch in which it actually did exist." No student of carcinoma can deny the truth of these remarks. This being the case, it seems reasonable to believe that scientific data on the subject will never be obtainable in humans for many, many generations, in fact, until the time when all who die shall be autopsied and studied by skilled pathologists.

Yet, in the meantime, there is the greatest need of impressing the medical profession with the fact that early carcinoma alone is curable and its diagnosis in that stage is often a very difficult matter. Anything that focuses the mind of the practitioner upon the diagnosis of early cancer should be of value. There is, we believe, strongly suggestive evidence which, while not qualifying as scientific proof, is quite enough to convince any thoughtful practitioner of medicine that descendants of cancerous patients or persons with cancerous relatives should be viewed medically as more likely to have cancer than those in whom there is no family history. Sickness from cancer which causes death is rarely confused with any other disease and makes an impression upon others of the family which is passed on to several generations following, provided always that the individual knows the family. This view, of course, does not permit consideration of the fact that many individuals, while having cancer, die from some other disease before cancer gives sufficient clinical manifestations to call attention to its presence.

Classification of Uterine Cancer, According to Histology.—Following along the general lines established by Broders,[54] in *Cancer of the Lip,* Martzloff,[55] in 1923, reported histological and clinical study of 387 cancers of the uterus seen in the Johns Hopkins Gynecologic Department prior to 1920. The object of this study was to determine whether there was a definite relation between the histomorphology of the predominant cancer cells and the degree of clinical malignancy. The material fell into three histologic groups, according as the predominant cancer cells were spinal-celled type, fat spindle, or transitional. The investigator's work showed that the tumors composed chiefly of spinal-celled forms were the least malignant, the transitional celled type were more malignant and the fat spindle-celled type were the most malignant. The adenocarcinoma fell between the spinal and transitional-celled groups in malignancy. Martzloff's observations warrant the belief that epithelial pearls in the carcinoma are significant only when they occur in the spinal-celled group of

tumors when they indicate a lessened degree of malignancy. He found that there were carcinomatous extensions from the primary tumor into the broad ligament in the first six months of the symptomatic disease in all groups except the spinal-celled type. Less than 10 per cent of the patients with broad ligament involvement lived more than one year following operation.

Pomeroy and Strauss,[56] in 1924, reported a series of cases studied along the same line. Their material consisted of 75 cases which were carefully studied. This material fell into the following groups: 6 cancers of the spindle-celled type with pearls; 31 spindle-celled type without pearls; 21 transitional-type tumors; 6 fat spindle-celled type growths and 11 adenocarcinoma. The cases which did best clinically were the spindle-celled type without pearls and the adenocarcinoma. They found, moreover, that 71 per cent of the cases in which radium gave marked palliation were transitional-celled types. Their work brings up the question as to whether the transitional-celled type cases are not very likely to respond favorably to radium.

Radium Treatment of Cervical Cancers.—Von Seuffert,[57] in 1922, reported Doederlein's results with mesothorium and radium in a series of 500 cervical cancers in Munich. The cases were observed between 1913 and 1916 inclusive and were contrasted with the results that were obtained with the 265 cases that were operated between 1908 and 1912 inclusive. Doederlein divided his material into two groups, one which was radiated completely and the other which left before the treatments were finished. He claimed to have cured by radium substances for a five-year period, 10 per cent of the inoperable cases, which were radiated completely; 36 per cent of the border-line cases of the same groups; as well as 80 per cent of the operable cancers. Less favorable results were obtained in the series which he says were incompletely radiated, although he claims a five-year cure in 20 per cent of the border-line cases and 48 per cent of the operable cases in this subdivision. Doederlein has not operated a cervical cancer since 1913. Von Seuffert contrasted the results obtained by radium with the 265 cases which had been treated by surgery, in which cure was obtained by operation in only 5 per cent of 57 border-line cases and in 46 per cent of 110 operable cases. There was injury of the adjacent tissue in 9 per cent of the cases radiated and of 10 per cent of the cases which were operated. He said that even in the cases which were not cured by radium, the duration of life was 50 per cent greater in the operable group than in the similar cases that had been treated by surgery; 45 per cent greater in the border-line cases that were radiated than those which were operated, and 55 per cent greater in the inoperable cases than in those which had been untreated prior to 1913.

Seitz,[58] in 1922, reported his five-year cures with cervical cancers that were treated by small doses of radium and the Roentgen ray. Fifty per cent of 8 cervical cases and 17 per cent of 18 border-line cases were alive and free from symptoms five years after the beginning of treatment. Of the total group of 58 cases with cervical carcinoma, 12, or 20.9 per cent, are still alive. Seitz states that these figures compare favorably with those treated by the Wertheim operation, a point which we feel is quite unfair. To be of the

greatest value, the comparisons on the results of surgery and radium should be made in similar groups. Seitz quoted the statistics of a number of other authors in German literature. He stated that Doederlein treated 205 cervical cancers with radium with 40 survivals for the five-year period (19.5 per cent); Bumm treated 78 cases with radium with 11 five-year survivals (14 per cent); Baisch, 42 cases with 7 survivals (16 per cent); Klein, 73 cases with 8 survivals (12 per cent); Heyman, 26 cases with 7 five-year cures (26.9 per cent). Seitz believes that the excellent results obtained in his series were not due entirely to the radium but that the Roentgen ray played a very important part. Thus, there were 56 per cent of five-year cures of the patients treated predominantly by the Roentgen ray and 53 per cent of five-year cures in the cases treated exclusively with radium, percentages which are practically identical.

Beuttner,[59] in 1923, reported his five-year cures in a series of 63 cases treated by him in Geneva. Four of 9 operable cases were cured as were 4 of 8 border-line cases, and 3 of 25 cases in which there was a crater of the cervix and a comparatively slight infiltration of the parametrium. As a result of his study, Beuttner reached the same conclusion as did Doederlein, who stated that he could have cured by operation only about 50 per cent of the patients who appeared to have been cured for four or five years by radium.

Heyman,[60] in 1924, reported the results of 505 cervical cancers during 1914 to 1921, inclusive, in the Radiumhemmet in Stockholm. The report appears well controlled and perfectly convincing. Each case counted as a five-year cure was examined by the author five years after treatment, the cases being brought back to Stockholm for examination by a government grant. All cases dying within the five-year period were counted as due to cancer although it may be that death in two or three cases was not due to cancer. There were 217 cases available for the five-year study; 19, or 8.7 per cent, being operable and 181, or 91.3 per cent, were border-line and inoperable and were studied together, while treatment was refused to 7.5 per cent in which the growth was too late for treatment. Five-year cures were obtained in 8 of the 19 operable cases, or 40.5 per cent, while 30 of the 181 inoperable and border-line, or 16.6 per cent, remained symptomatically cured five years later. There were 5 deaths immediately following treatment, or 1.2 per cent of the total number of 905 cases.

Less glowing accounts of radium cures have been reported in America. Bailey and Healy,[61] in 1923, reported the follow-up study of 908 cases of uterine cancers treated by radium at the Memorial Hospital in New York. In the series there were 11 early operable cervical cancers in which five-year study was permissible. Of these, 3, or 27 per cent, were alive and free from evidence of cancer for five years or more. This percentage of cures is probably lower than the actual fact since there were 3 deaths from intercurrent diseases and one following operation in another clinic during the period of the follow-up. There were 33 cases of border-line cervical cancer, of which 8, or 25 per cent, were alive five years after, and all but one were

known to be free from evidence of the disease. There were 123 advanced primary cervical cancers, of which 8, or 6.5 per cent, were alive five years later.

Clark and Block,[62] in 1924, reported the results of radium treatment in their series of 144 cervical cancers treated in the University Hospital in Philadelphia. Five-year cures were obtained in 27.2 per cent of 22 operable cases, and in 6.7 per cent of 118 inoperable cases. There were 4 recurrent inoperable cases with 25 per cent of five-year cures. In the entire series of 144 cases, only 15 per cent of which were operable, there were 10.4 per cent of five-year cures by radium. Clark believes that his results show that while radium has been of the greatest help in the relief of inoperable cases and has effected a cure in a small percentage of those who otherwise are doomed, it nevertheless falls far short of an ideal remedy. The results of his radiation cases compared favorably with those of his radical operations. In such a series of cases treated and reported from his clinic in 1913, there was 33 per cent of five-year cures together with an 8 per cent incidental mortality. In his 22 operable cases treated by radium there was no primary mortality; and only 27.2 per cent five-year cures. Clark says that if the 6.7 per cent of five-year cures of inoperable cases treated by radium is added to the 27.2 per cent of five-year cures by radium in the operable cases the total is practically equivalent to that obtained by radical operation but without the many distressing sequelæ incidental to the latter. It appears to us, however, that a better result might have been obtained in the entire series if the early operable cases had been operated and all others had been treated by radium.

Schmitz,[63] in December, 1924, reported his five-year results in a series of 103 cervical carcinoma treated by radium and Roentgen ray. At the end of five years there were living and apparently symptom-free 15 cases, or 14.5 per cent, of the total. Schmitz divided his material into four groups: Group one being comprised of the clearly localized single growths for which he believes radical surgical excision is indicated and would have been performed had there not been contra-indications for operation; group two containing the operable cases in which there was a suspicion of beginning invasion of the tissue surrounding the growth, and which he believes should be treated with radium and Roentgen ray and subsequent radical surgical excision: group three containing the cases ordinarily considered inoperable, the treatment for which is radium and Roentgen ray; and group four, comprised of the late inoperables with extensive involvement and distant metastases for which palliative and symptomatic treatment alone was recommended. Schmitz states that he has living five years after beginning treatment all three of the three early operable cases of group one, which were treated only by radium and Roentgen ray; 6, or 40 per cent, of the 15 later operable cases of group two; 6, or 10 per cent, of the 60 inoperable cases of group three; and none of the 25 cases of group four.

In 1924, Greenough[64] presented the preliminary report of a committee appointed by the American College of Surgeons to study the treatment of malignant diseases with radium and Roentgen ray. The material includes

829 cases but will not be considered here because the report is concerned with three-year cures, whereas we feel that, especially with radium cases, it is useless to study anything less than five-year cures.

Our own results may be of some interest, since it is known that the cancer mortality in San Francisco is higher than that of any other city of the United States. Between March, 1916, and March, 1921, 107 cancers of the uterine cervix applied for treatment. We treated all with radium only, surgery alone, or both in combination. Twenty-five had recently been operated before entering our service. Twenty-three of these had been operated for cancer by panhysterectomy with removal of tubes and ovaries and had been sent in for radium as a prophylaxis or for recurrence after their non-radical operation elsewhere. Two had had cancer unsuspected before a recent cervical resection; proved in one by the routine laboratory examination after operation and in the other only when the growth started to grow rapidly. There were 82 who had not been treated for cancer before admission. Sixty of these were inoperable and late border-line cases and 22 we classed as operable. The later group consisted of 4 early and 15 late operable (Group I) and 3 border-line cases. Three only of the 102 cases were lost from the follow-up after having been followed for three years. Six died of intercurrent disease.

Fifty-nine inoperable and border-line cases were treated by radium alone by the technic above described with 5, or 8.5 per cent, cures without deductions for the one case that was lost from the follow-up and the 2 cases that died of intercurrent disease. The case that escaped the follow-up was 63 years old at time of treatment, and was last examined three and a half years after, when there was no evidence of recurrence. Her death is not reported in the Bureau of Vital Statistics in any of the coast states. The deaths from intercurrent disease are composed of one inoperable case, aged 44, who had been well for two and a half years and whose pelvis was negative just before she was killed in an automobile accident; the other, aged 79, with an early border-line adenocarcinoma, died from pneumonia three years after treatment at a time when the pelvic condition indicated a potential cure. We operated one inoperable case after her tumor had disappeared following radium treatment. She remains well eight years following operation. We do not attempt to draw conclusions from this case, so classify it with inoperable cases treated with radium. The table is as follows:

Inoperable and Border-Line Cases Treated by Radium Only

Number of cases	59
Lost	1
Dead	53
Dead of cancer	51
Dead of intercurrent disease	2
Dead within three years	47
Dead from three to five years	6
Alive and well, five years	5 (8.5 per cent)

The operable cases which were radiated and not operated consist of 5 women, one of whom refused operation, one in whom operated was contraindicated by age, one by heart disease and two by their poor general condition. Two had squamous-celled epitheliomata. Sections were not taken from the others, all of whom died cancer deaths. Only one case remains cured for five years. One died of her heart condition a year after treatment.

We operated 17 women, in 9 of whom radium was used preoperatively or postoperatively. One died a year after operation from cerebral apoplexy. Two cases were lost to follow-up. They were women of 34 and 48 respectively who were well for more than three years after operation and whose deaths have never been reported in the Bureau of Vital Statistics in any of the Pacific coast states. One developed a fistula of the ureter immediately after operation and died following a secondary repair six weeks after the primary operation. She is recorded as an operative death. One woman developed a ureteral fistula due to cancer three months after her operation. Eight of the 17 women were well from five and a half to ten years after and with no evidence of return of cancer, 46 per cent of cures without deduction for the 2 cases that were lost or the one that died of intercurrent disease. The table is as follows:

RADICAL OPERATIONS ALONE, OR WITH PREOPERATIVE OR POSTOPERATIVE RADIUM

Number of patients	17
Lost	2
Died of intercurrent disease	1
Died at operation	3
Died of cancer	3
Died within three years	3
Died three years plus	0
Alive and well, from five and one-half to ten years	8

Operative mortality 16.6 per cent; cure in operative cases, no deductions, 47 per cent.

Our results with the radium as a prophylaxis or for recurrence after a panhysterectomy have convinced us that whatever the future will determine as to the relative value of truly radical surgery and of radium in operative cases, there is no doubt whatever but that the ordinary panhysterectomy has no place in the treatment of cervical cancers. None of the 23 cases that were radiated after hysterectomy lived more than three and a half years in spite of the fact that they had all been operated by competent surgeons at periods from two weeks to one year previous to our postoperative irradiation. In contrast, we have 5 of 59 inoperable cases that were cured by radium alone. Both cases in whom the cancer had been found accidentally after a cervical resection remain free from recurrence after their radiation.

Our results confirm the view that five years' freedom from recurrence is the minimum which can be considered a cure. Thus, in our operative series, one case lived three and a half years and then succumbed to cancer; the 3 operable cases that were treated only by radium survived between three and three and a half years before succumbing to the disease. Another, a so-called recurrence after operation which we treated by radium, lived three and a half years. These would have been counted cures in a three-year standard.

Roentgen Ray Supplemental to Radium in Treatment of Cancer.—The question is frequently debated as to what extent the deep Roentgen ray contributes to the cures of cases treated primarily with radium. Little help can be obtained from the older literature because of the great improvements that have been made in Roentgen ray during this time. Zweifel,[65] in a meeting of the German Gynecologic Congress, in 1922, stated that the results of Doederlein during the years 1917 and 1919 were improved by the addition of Roentgen ray only from 48 per cent to 54 per cent for operable cases and from 6 per cent to 7 per cent for inoperable cases, but we feel that very much more can be obtained at the present time. The fact that deep Roentgen ray alone occasionally cures is shown by Bumm's report in 1922 that he had cured for five years or more, 3, or 13.6 per cent, of 22 operable cancers. The addition of deep Roentgen ray to vaginal extirpations increased the percentage of cures in Amann's [66] clinic in Munich, up to 1923, from 39 per cent to 61 per cent, for a series only one-fifth of which had been observed for five years. While it is undoubtedly true that the literature does not show what can be accomplished by the addition of modern Roentgen ray to radium treatment of cervical cancers, there are few at the present time that do not consider it a necessary adjunct.

Treatment of Cervical Cancers.—The literature of the past few years proves that radium cures: A small percentage of absolutely inoperable growths; more border-line cases than surgery; and about the same number of operable cases as surgery is reported to do. It insists that this is accomplished without noticeable primary mortality, a prolonged hospital stay, or serious post-operative sequelæ. It urges that the technic of radium treatment is constantly improving, and that the results at the present time are by no means as good as may be obained in a few years, especially if the radium treatment is supplemented with the deep Roentgen-ray therapy. For these reasons, the advocates feel that surgery should be abandoned in favor of radium in the treatment of cervical cancers.

There is no doubt but that this contention is true, assuming that the treatment is conducted by one skilled in the use of radium and that the surgical treatment is in the hands of men who are not doing truly radical operations. If the surgeon practices only the ordinary abdominal or vaginal panhysterectomy, we feel that the case will do better with radium followed by Roentgen ray than by such operative procedures.

Personally, however, we are not at all convinced that radium should be used rather than surgery in the treatment of early cervical cancers, provided a truly radical operation is done (Fig. 2). This opinion is based upon

our own experience confirmed by study of the literature. We are much interested in the fact that Heyman, while curing 16.6 per cent of 181 inoperable and border-line cases in Stockholm, cured only 8 of 19 operable cases in a city in which surgery had been abandoned in favor of radium because of the excellence of the radium results. And in the report of Clark, who cured but 5 of the 22 operable cases which he radiated, and in our own series in that we are not likely to cure more than 2 of 7 truly operable cases. The fact that radium does not cure 100 per cent of local growths suggests that

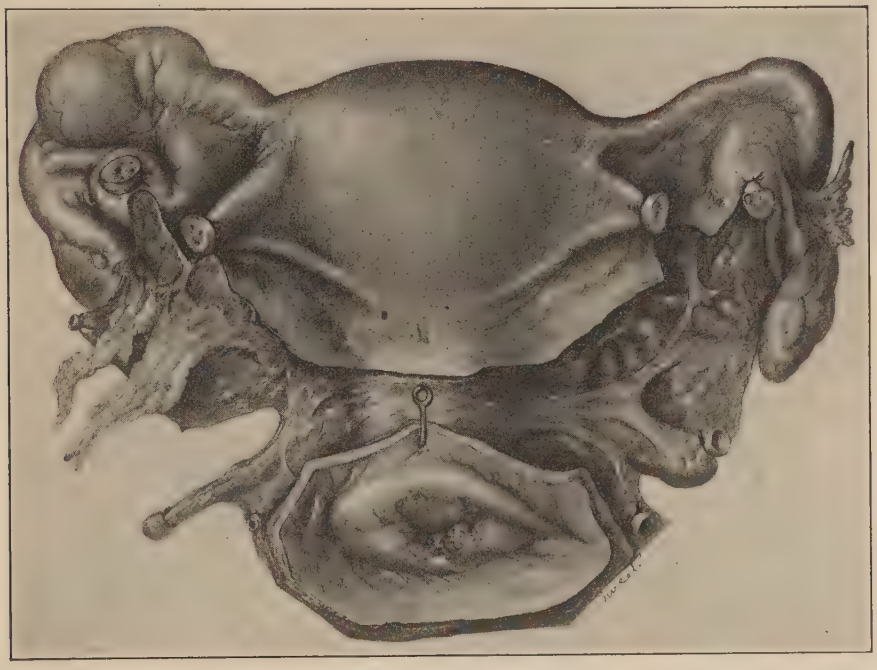


FIG. 2.—ILLUSTRATING EXTENSIVE DISSECTION AND REMOVAL OF PARAMETRIUM AND BROAD LIGAMENT IN A RADICAL OPERATION FOR EARLY CERVICAL CARCINOMA

The uterine vessels have been ligated almost at their point of origin and the ureter has been freed from its bed. There was a double ureter on the right side.

there is more to the cure of the cancer than the destruction of the tumor by radium, and it is the action on the system by the radium which produces curing factors which are vital to the success of the treatment. No one can believe that inoperable cancers are cured solely by the action of radium upon the tumor cells, since there are often cancer cells far beyond the reach of the rays. It seems logical to believe that a protective substance has developed in the body in reaction to the tumor which aids in marked degree the local effect of radium on the cancer mass, and that nature has not yet developed its protective mechanism in the small early growths. The tumor in 2 of our operable cases treated by radium was extremely small, and we feel confident that, had surgery been possible, it would have resulted in a cure.

We do not feel that the literature at the present time contains a report of

enough operable cases treated by radium to warrant any definite opinion as to whether surgery or radium is the better method. There are only 150 operable cases in the literature we have cited above with 52 per cent of the cures. Yet the percentages of cures vary tremendously, from 27 per cent for the series of Clark and of Bailey, to 80 per cent for Doederlein and 100 per cent for Schmitz. Detailed study of the reports shows that, with the exception of the Doederlein series, the maximum number of cases in any one series is 22, while another series had only 3 cases. Thus Seitz reported 8 operable cases with 4 cures; Beuttner, 9 operable cases with 4 cures; Heyman, 19 cases with 8 cures; Bailey and Healy, 11 cases with 3 cures; Clark, 22 cases with 5 cures;

FIG. 3.—ILLUSTRATING WIDE AREA OF VAGINAL RESECTION ESSENTIAL WITH OPERABLE CERVICAL CARCINOMA

The patient is living and free from subjective and objective findings five years after operation.

Schmitz, 3 cases with 3 cures; Doederlein, 43 operable cases completely radiated with 35 five-year cures, and 34 operable cases incompletely radiated with 15 cures. The latter series was the one whose patients felt so greatly improved that they did not return for the rest of the treatment. Doederlein's complete series of operable cases shows 65 per cent of five-year cures. Were others able to equal this percentage, there would be no doubt of the superiority of the radium. Yet the 72 cases reported by Seitz, Beuttner, Heyman, Bailey and Healy, Clark, and Schmitz gave only 27 cures, or 37.5 per cent.

Truly radical surgery has accomplished far more. Von Franqué's [67] report showed 80 per cent surgical cures for five to eight years, Faure [68] cured 50 per cent of 71 cases but more than 80 per cent of the very early cases, while Bumm in a larger series obtained 49 per cent or 77 cases out of 157 operated who were cured for six to eight years, and Wertheim's older series of 160 cases living and well out of 380 who were operated five or more years before,

43 per cent. The small but remarkable series of Ries is cited in the text. These points reënforce us in the opinion we gave in 1919 [69] that only the early and truly operable cases should be treated by very radical surgery and that all others should be treated by radium and the deep Roentgen ray (Fig. 3). We feel, however, that all cases should have deep Roentgen-ray therapy as a supplementary treatment, no matter whether the case was treated primarily by operation or radium. Moreover, we radiate all cases two weeks before operation with approximately 2000 mc.-hours. At the present time, we are much interested in the technic of Heyman, to whose articles [60] we refer those interested.

Carcinoma of the Uterine Body.—Norris and Vogt,[70] in 1924, as a result of an exhaustive study of 115 cases confirmed our belief at the time the text went to press that the treatment of choice of carcinoma of the uterus is operation and not radium, the operation being supplemented by postoperative irradiation.

Ovarian Carcinoma.—In marked contrast to cervical cancers, the literature is indicating that there may be occasionally a hope of curing by surgical removals some ovarian carcinoma that have been incompletely removed by surgery, if the cases are subsequently treated with the deep Roentgen ray (Fig. 3). This method occasionally gives better results than the Roentgen-ray therapy alone, since the rays do not appear to act well until most of the cancer has been removed by surgery. While it is not possible to talk of five-year cures at the present time, we have had several striking results which were at least distinctly palliative. One of our cases, an incomplete removal, lived more than one year, dying from an aplastic anemia. No cancer cells were found at autopsy. The question naturally arises as to whether the Roentgen-ray treatment contributed to the anemia, yet the case is most interesting.

Chorionepithelioma.—On page 319 of *Pelvic Neoplasms,* we cite a chorionepithelioma reported by Rockafellow in which, after removal of the uterus, metastases developed in the labia. Sometimes they were as large as a kidney and, when excised, returned in a week or so. After four operations for recurrences, the patient's condition became so bad that it did not seem worth while to again attempt removal. To every one's surprise, the growths began to shrink spontaneously, and the patient improved to regain good health. Rockafellow writes us that this patient was again examined in June, 1923, ten years following operation. There was no sign of recurrence and the patient had gained weight from 84 pounds to 146 and seemed in perfect health.

Such cases, although extremely rare, together with the few cases of ovarian cancer which occasionally have improved remarkably after incomplete removal and Roentgen-ray treatment, serve to emphasize the view that the cure in malignant neoplasms is at least partially dependent upon the development in the body of reactionary protective substances, which may be even equal to the local treatment.

RECENT DEVELOPMENTS IN THIS SUBJECT

TUMORS OF THE OUTLET

Sarcoma of the Outlet.—This is a very rare lesion. Gatter,[71] in 1926, reported a sarcoma of the perineum in a woman of 71 years. This mass presented as a small nodule which the patient had noticed for six months. Examination disclosed a partly ulcerated tumor about the size of a walnut in the middle of the perineum. It was removed under a local anesthetic. The microscopic diagnosis was spindle-celled sarcoma. There was no recurrence after six months.

Sweat-Gland Tumors of the Vulva.—Since their first recognition by Pick in 1904, only 22 cases of these tumors have been reported. They are usually small, not larger than a bean and may be single or multiple, unilateral or bilateral. The microscopic picture is that of an intracystic papilloma with innumerable irregular acini whose tubules are lined by a double layer of nonciliated cells. The tumor appears usually as a circumscribed firm or cystic nodule under the skin and rarely causes symptoms unless ulceration or infection occurs. Hoeck [72] reported a case in 1926 which presented as an almond-sized broad-based polypus growing from the inner aspect of the left labium majus. The literature indicates that these growths are essentially benign.

Malignant Melanoma of Vulva.—Melanomata are tumors characterized by a variable amount of iron-free pigment (melanin) in the tumor cells. The term melanoma is a group name now used to designate all pigmented tumors that were formerly termed melanocarcinoma, melanosarcoma, etc. It is proper since it designates and emphasizes the specific character of the cells which compose the tumor. Melanomata are most common in locations which have the most body pigment. The tumors have received much study and there are many theories of their origin.

Histogenesis.—Some investigators claim that melanomata are of mesoblastic origin and the pigment present in the epidermal cells is diffused from the corium where it originates. Ewing [73] inclines to the view that the tumors arise from the epidermis and that the corium pigmented cells have become possessed of pigment by diffusion from the parent epidermal cells. Dawson,[74] in a comprehensive review of melanomata, is convinced of their epidermal origin and interprets "the diversity of structural arrangement and cell type" seen in practically all such tumors as one of the amazing powers of anaplasia and redifferentiation of the epidermal cell. He holds that the pigment cells arise from the basal layer of the rete malpighii and suggests that the pigment is elaborated either from the blood pigment or by secretory activity of the nucleus or nucleolus or by a special metabolic function of the cell itself.

Frequency.—Melanomata of the vulva are rare yet their presence is of such grave significance that any contribution to the study of their etiology or prophylaxis is most important. Nicholson [75] noted that while pigmented moles and nevi are the commonest manifestation of congenital malformation and occur in 90 per cent of people, melanomata are, fortunately, relatively uncom-

mon; hence it cannot be claimed that these pigmented moles are more especially predisposed to tumor formation than any other form of body tissues. There seems to be no doubt, however, that the majority of malignant melanomata have originated from pigmented moles or nevi. These moles may occur any place on the body. Bland Sutton [76] has pointed out that the skin about the genital organs is normally rich in pigment. Veit [77] and Reed [78] state that pigmented spots are more common on the vulva than any other part of the body, yet relatively few cases of malignant vulval melanoma arising from vulval moles are recorded. Holland [79] reports melanoma in the clitoris and collected 52 cases from the literature, 37 of which were classified as vulval melanomata. The tumors were situated as follows: 12 on the labium majus; 15 on the labium minus and clitoris; one on mons veneris; one near the urinary meatus; 8 involving entire vulva. Veit adds 3 additional cases; all were primary on the labium majus. Reed reports a melanoma of the urethra and additional cases have from time to time been mentioned. Hirst [80] saw 2 cases involving the labium majus; Lockhart [81] reported a melanoma of the clitoris and cites similar lesions observed by La Fleur and Verse respectively. MacCarty and Broders,[82] studying 70 malignant melanomata in the Mayo Clinic, found 2 originating in labial moles. More recently Ivens [83] published a case of melanoma of the clitoris; Goforth [84] collected 3 cases, all arising in the labium majus; Maclean [85] described a melanoma of the vulva.

Diagnosis.—The presence of a benign pigmented mole or nevus on the vulva should be regarded as a hazard and such growths should be regarded as potentially malignant. Such an alteration is usually ushered in by the following changes: A pigmented mole which has not varied in size for several years slowly begins to enlarge and becomes more heavily pigmented and vascular. Ulceration may occur early and be followed by frequent hemorrhages. The origin of the degeneration may be spontaneous but usually there is a history of trauma or mechanical irritation of exposed surfaces from the clothing or the application of caustics or imperfect attempts at removal. Repeated scratching from pruritus vulvæ may be an exciting cause. Pregnancy may stimulate the growth to rapid malignancy. Hirst reported a melanoma of the vulva occurring during pregnancy and ending fatally in four weeks. A variation in malignancy, however, must be recognized, for Goforth mentions a vulval melanoma beginning and being removed in pregnancy; the woman was free from recurrence for five years. Although a wide removal of the tumor was then done, shortly after a third nodule appeared. A wide excision and inguinal adenectomy was done by J. G. Clark, but within six weeks the lesion appeared again. This was radically removed by a cautery knife. Within a year and a half, a fifth recurrence was excised by a cautery and radium was applied. The woman died within a year, presumably from a fatal recurrence, and almost ten years after the initial lesion.

The regional lymph-nodes become early involved, the tumor spreads chiefly by the deep fascial lymphatic plexus. As a rule, generalization of the growth is apparent within three years from the beginning of the malignant change, which becomes established through direct invasion of a vein or capillary from

either the tumor or involved lymph-nodes or by means of the lymph glands directly through the thoracic duct to the blood stream.

The importance of any alteration in size or appearance of a vulval mole cannot be overemphasized. Local discomfort or pain in the groin, palpable inguinal glands, discharge or hemorrhage are pathognomonic of a malignant degeneration of the tumor.

Treatment.—In view of the bad prognosis with any form of therapy when the tumor is well established, the basis of treatment is essentially prophylactic. Vulval pigmented moles should be regarded as premalignant lesions and with the onset of any unusual signs or symptoms should be checked by "a radical extirpation of the involved area with a good zone of surrounding healthy skin and a somewhat larger zone of the underlying deep fascia up to and including the nearest anatomical glands at least; all that is removed should be in one continuous strip as far as possible" (Dawson). The cautery knife is the ideal instrument for this removal because of its ability to seal the lymphatics. When malignant degeneration is proved, the same dictum holds true except that even a more extensive removal is imperative. Recurrences should be treated in a similar manner. Postoperative radiation has proved to be of little value in preventing the spread of the tumor, for the rapid rate of dissemination of metastasis prevents adequate raying. At times, however, radiation may relieve the pelvic pain.

In general these tumors are characterized by extreme malignancy and nearly all cases of vulval melanoma have terminated fatally. One of Holland's series of 52 cases was free from recurrence three years after operation. Ivens' patient with a melanoma of the clitoris was apparently cured one and a half years after operation. He suggests that the absence of ulceration or fixation of the tumor, lack of involvement of the inguinal glands and possibly the irregular pigmentation of the growth were favorable factors affecting the prognosis. In Goforth's series of 3 cases, one woman was free from recurrence seven and a half years after radical excision (by J. G. Clark). The removed lymph-nodes were free from involvement and were enlarged from acute and chronic inflammatory changes.

A review of this subject would indicate that successful treatment of melanomata will depend upon the recognition of the potential malignant qualities of vulval moles or nevi and their radical excision before they have reached a malignant stage.

ENDOMETRIOMATA

The study of tumors containing endometrial-like tissue continues to interest the gynecologist both from the standpoint of etiology and of treatment. Pathological conditions not previously recognized or wrongly interpreted are now being properly evaluated and numerous publications stimulate further investigation.

Terminology.—Many methods of terminology have been advanced to designate these growths. Ovarian hematoma, adenomyoma, endometrioma, ectopic adenomyoma, are terms frequently found in the literature. Bailey,[58]

in 1924, suggested the name "ectopic müllerianoma" as more properly indicating the origin of both the uterine and the extra-uterine types of this tumor. Frankl [87] chose the term adenomyosis for the uterine growths since it does not suggest an inflammatory basis of etiology as does adenometritis, adenomyositis and adenomyometritis. Sampson,[88] whose study of these neoplasms has been a great stimulus for further investigation, feels that it is difficult to select a proper nomenclature for misplaced endometrial or müllerian tissue. Since these growths develop from both tubal and uterine mucous membrane, the term müllerian would be proper and inclusive, but unfortunately it suggests an embryonic origin. He contends that a great variety of lesions may be produced by this misplaced tissue, not all of which can be regarded as true tumors. Consequently he feels that endometriosis or müllerianosis would more properly describe the various conditions than the older terms, endometrioma or endometriomyoma. Sampson's paper, in 1912, on endometrial hematomata or cysts of the ovary, proved epoch making. His theory that the transplants arose from uterine or tubal mucosa aroused the greatest interest in this little-known tumor. As early as 1905, Pick [89] had described these cysts, called them adenoma or cystoma endometriodes ovarii, and pointed out their similarity to the cystosarcoma adenoides ovarii uterinum described by Rokitansky in his textbooks of pathological anatomy published in 1861. Few, however, became interested in the tumor and little was known of the possibilities of their origin until Sampson's investigations.

Sampson [90] divided misplaced endometrial or müllerian tissue into four groups with the possibility of one other, according to the manner in which this tissue reaches its ectopic situation, namely:

1. Direct or primary endometriosis (müllerianosis), *i.e.*, misplaced endometrial tissue in the uterine wall which can be demonstrated to have arisen from direct invasion of the myometrium by the uterine mucosa from the cavity—the so-called adenomyoma of mucosal origin. A similar condition arises in the wall of the tube by an invasion of its mucosa.

2. Peritoneal or implantation endometrioses, in which implantation deposits of endometrial tissue are found scattered throughout the pelvis, similar in their distribution to the peritoneal implantations of cancer, and, like the latter, often invading the underlying structures.

3. Transplantation endometriosis in which the endometrial tissue occurs in the scars of the abdominal incision after operations on the pelvic organs.

4. Metastatic endometriosis, a group which includes extraperitoneal endometrial tissue in situations similar to those of the metastasis from cancer of the pelvic organs, including peritoneal carcinosis.

5. Developmentally misplaced endometrial tissue—which is a possibility but probably of infrequent occurrence.

Sampson believes that a back flow of menstrual blood is largely responsible for these lesions, the blood backing up from the uterine cavity through the tubes, carrying with it into the peritoneal cavity fragments of uterine epi-

thelium, and occasionally tubal mucosa when that tissue reacts to menstruation. This cast-off epithelium becomes implanted wherever it lodges in the peritoneal cavity. In its subsequent growth it may invade its underlying tissue, spread superficially or may invade any contiguous structures. These implants react with menstruation, at which time also they may cast off epithelium, thus giving rise to secondary transplants. Peritoneal implants are usually slowly growing and insignificant and rarely become invasive and spread. Ovarian transplants, on the contrary, find a most fertile soil in the ovary; therefore they grow more rapidly than do the peritoneal implants and develop into superficial or deep menstruating ovarian cysts. Usually these ovarian cysts soon perforate; their contents of old menstrual or chocolate-colored blood and cast-off epithelium escape into the peritoneal cavity and give rise there to secondary implants. Both the chemical and cellular contents of menstrual blood are most irritating and soon induce a peritoneal reaction such as occurs in peritonitis of bacterial or malignant origin. Dense adhesions are the rule, especially when the cyst has ruptured slowly. The uterus, broad ligament, or bowel, or all, then become firmly bound up with the ovary in a mass of adhesions. If the hematoma has not ruptured but is entirely surrounded by ovarian tissue, there need be no adhesions. Sampson suggests that the ovary may not only act as intermediary host but may impart a greater virulence to the endometrial tissues growing in it. Furthermore, he believes that endometrial particles may metastasize through lymph channels or venous sinuses in the uterine wall. Just as metastatic carcinoma may be found at a distance from the primary or secondary situation so has benign endometrial tissue been found in similar conditions and even in pelvic lymph-nodes. As early as 1897, Ries [91] described epithelial glands or ducts in iliac lymph glands removed from a patient who had a cancer of the uterine cervix and an associated uterine adenomyoma. There were epithelial glands also in the left uterosacral ligament similar to those found in the lymph-nodes. Ries concluded that the glands in both places were from remnants of the wolffian body.

Sampson feels warranted in stating that "invasions and disseminations of benign endometrial tissue employ the same channels as the invasion and dissemination of cancer." He feels that the cellular and chemical elements of the menstrual blood escape into the uterine sinuses, remain there or are deposited in other parts of the body just as bacteria, syncytium, or chorionepithelioma in better known conditions.

Sampson's theory has received support from experiments made by others. Jacobson,[92] in 1926, described his attempts to make intraperitoneal transplantations of endometrium in rabbits and monkeys. When the operation was performed during estrum, in a series of 19 rabbits, implantation occurred in 16 (84 per cent). In 6 rabbits so treated during the resting stage, a "take" occurred in but one. Six rabbits were operated during pregnancy; implantation occurred in 2 (33 per cent). This suggests an increased virulence of rabbit endometrium during estrum. In 5 castrated animals, ectopic endometrial growths showed similar atrophic changes as seen in the uterine cornua. The implants were of cystic adenomatoid structures, often multilocular, and

developed on the broad ligament, vagina, uterus, bladder and intestines. Five monkeys (Macacus rhesus) were subjected to hysterotomy, curettage, and intraperitoneal transplantation of curettings. Ectopic growths confined to the uterus and surrounding adhesions were produced in 4 animals, possibly as the result of operative trauma. One monkey killed when actually menstruating showed ectopic endometrial tissue on the uterus and in the ovary, which was also menstruating. Jacobson concludes that the successful inoculation of their own endometrium upon the peritoneum of the rabbit and monkey, the general location of the growths produced, their histological character and the manner of their reaction to the ovarian hormone favor Sampson's theory of the origin of most ectopic endometriosis in humans. Ferracciu,[93] in 1926, experimenting on dogs and rabbits, incised the body of the uterus, removed the uterine mucosa on a knife blade and scattered the particles on the internal genitals and abdominal organs. In a second group, he removed the embryos from pregnant dogs and scattered decidual fragments in the pelvis and abdomen. Both groups were negative. In a third series, however, he resected a portion of the uterine horn, cut it into fine bits and scattered them on the pelvic organs in the peritoneal cavity. In a short time, various sized cysts formed, some on the abdominal organs and others scattered over the parietal peritoneum. Only once was a cyst formed on the ovary, which may be explained by the fact that in these animals the ovaries are high in the abdominal cavity and difficult of access by the implants. The inner walls of the cysts were lined with epithelium similar to that of the uterine cavity.

While Sampson's ingenious explanation of ectopic endometrial tissue has aroused much interest and has received support by many gynecologists, his theory has not received universal acceptance. In the previous issues of this monograph, mention was made of other theories to explain the origin of these lesions, namely that of von Recklinghausen who thought they developed in adult life from rests of the wolffian body. Congenital remnants of müllerian tissue have also been suggested as the point of origin. While these speculations are of interest, they do not serve as an explanation of the origin of these growths at places remote from the uterus, nor has the presence of these congenital rests ever been definitely proven. Cullen's theory of invasion of the uterine wall by uterine mucosa has been proved in many cases of adenomyoma in which connections have been shown to exist between the uterine lining and the glands lying in the adenomyoma. Finally, the theory of Ivanoff-Meyer has received numerous supporters, the notion of serosal metaplasia as the end result of inflammation or stimulation from ovarian hormones.

Novak,[94] as the result of his studies, is inclined to the belief that ectopic endometrial tissue can be referred to the normal developmental history of genital epithelium, all of which is derived from the cœlom epithelium of the urogenital folds. This not only forms the germinal epithelium of the ovary and the follicular epithelium but it also becomes invaginated to form the lining of the müllerian duct. The endometrium and the endosalpinx, therefore, are to be looked upon as mere modifications of the peritoneum. Hence, it is not surprising that either peritoneum or germinal epithelium may at times show

endometrial transformation. The factors which determine normal regional differentiation of the cœlomic epithelium are as yet unknown, although they may well be of endocrine origin. It is a well-known embryological law that tissues derived from the same embryonic mother epithelium are closely related. Furthermore, the developmental potentialities of that cœlomic epithelium which has reached the stage of germinal epithelium is not exhausted and is still capable of further differentiation into endometrium and endosalpinx under proper activating influence. He feels that this theory is substantiated by finding in ovarian endometriosis all stages of differentiation through which the genital epithelium normally passes, *e.g.*, simple endometrium-like epithelium with few or no invaginations, little or no stroma; more typical endometrium with or without menstrual activity; mucosa resembling that of the tube. He propounds these pertinent queries: If menstrual blood regurgitates through the tubes into the pelvis, why is it not frequently found in the abdomen of women operated during the menstrual cycle; why is it not found in the tubes of such women removed at operation, and why does not such blood cause peritoneal irritation similar to that seen in tubal abortion and seal up the tubes? He also points out the fact that tubes must be regarded as a one-way mechanism and likens them to funnels with the wide end open to receive ova and bits of tissue or cancer particles from the ovary which are carried downstream to the uterus. He shows sections of a tube blocked by a cell mass of endometrial-like tissue. He feels it is highly improbable that desquamated uterine epithelium of such size could fight its way upstream against the normal current, pass the uterine end of the tube with an orifice of 0.5 to 1 Mm., especially since the uterine cavity affords a much easier exit. There is no evidence of blockage of menstrual blood in myoma or uterine displacements, and endometriosis is often found with a normal uterus. Moreover, tissue lost at menstruation has been thrown off to die and it seems impossible that such degenerated tissue can force its way through the sphincter-like orifice of the uterine end of the tube against the normal currents where, in spite of many days of continuing degeneration and autolysis required for its passage, it can still grow where it falls. Novak concludes that the ovary, rather than being an intermediary host, is probably the point of origin for the implantation of endometrial-like tissue and such tissue derived from the ovary would possess greater vitality than would the menstrual fragments passed through the tube, because it could more readily be cast off from the surface of the ovary or be thrown off by the rupture of a hematoma without the influence of menstruation.

It is apparent from the above discussion that the etiology of ectopic endometrial tumors is not yet settled, yet numerous publications in recent literature demonstrate that many observers are studying this condition.

Distribution.—The presence of bits of endometrial tissue on various structures of the pelvis is of fairly common occurrence. Sampson [95] found this lesion in 64 of 296 abdominal operations in one year. In 45 of these cases, the lesions were small and without symptoms referable to them at the time of operation. The frequency of this condition apparently depends upon the thoroughness with which search is made during laparotomy. The cecum,

sigmoid and rectum have been involved in these lesions. "Adenomyoma" of the rectovaginal septum has long been recognized and its distressing associated symptoms noted. Endometrial tissue about the umbilicus has been reported. Involvement of the bladder wall has been reported by Keene [96] and others. Recently, the authors have seen a similar instance associated with widespread pelvic endometriosis. In Keene's 2 cases, intense bladder symptoms were produced by the invasion of the bladder wall which might easily be confused with a malignant process. Relief of symptoms and restoration to normal followed removal of both ovaries. Endometrial tissue has been reported in the abdominal scar after pelvic operations. Heaney [97] collected 29 such cases from the literature and reported 2 additional. Fourteen followed ventrofixation; 2, hysterectomy; 3, pelvic operations; one after oöphorectomy; 2, appendectomy, and several after operations on the pregnant uterus. His 2 cases also followed operations on pregnant uteri. Danforth [98] added another case following a cesarean section; the authors have noted one case following a cesarean section. Heaney remarks the infrequency of this condition after cesarean section, where there is so much chance of distributing endometrial débris that it would seem almost impossible to avoid contaminating the wound with these grafts. On the other hand, a considerable number of these lesions have occurred after ventrofixation, now a relatively infrequent procedure and one in which there would seem to be little opportunity for introduction of these transplants. These adenomata in the abdominal scar usually appear within a few weeks or months after the operations; occasionally they become manifest years later. The authors have seen one case developing two years after operation. They removed the nodule two years later. The nodules may be confused with small omental hernias. After a time, as fixation of the nodule occurs, they become elevated above the skin and take on a bluish puckered appearance. They are characterized by pain during the menstrual cycle.

Inguinal endometrial tissue was first found by Cullen [99] in 1896. In 1903, Emanueal [100] collected 76 cases of tumors of the round ligament. Taussig [101] reviewed the literature of round-ligament tumors and found endometrial tissue in 30 of the 135 cases in which the microscopic report had been given. Lockyer [102] states that the condition is three times as common in the extraperitoneal portion of the round ligament as in the intraperitoneal. In the former situation, they present as nodules in the labium major at the distal insertion of the ligament and their true nature may not be recognized. Swelling and tenderness with the menstrual cycle are pathognomonic of these lesions.

Outerbridge [103] reported 4 cases of cystic lesion of endometrial origin in the appendix in women. The tumors contained blood, were lined with columnar epithelium and were lying in the muscle wall or serous coat of the appendix independent of its mucosa. Similar cases have been reported by Sampson [104] and others. While there are comparatively few reported cases of such appendical lesions in comparison with those of other locations, this may be attributed to lack of observation and correlation of the existing pathology in the neighboring organs.

Symptoms.—The symptoms arise chiefly from the reaction of the peritoneum to the irritation of blood exuding from the transplants and ruptured ovarian hematoma. Usually a peritonitis is set up which agglutinates and immobilizes the uterus, tubes, ovaries, and loops of intestines. Dysmenorrhea is a constant complaint, which becomes increasingly severe; if the intestines are involved with transplants and adhesions, intestinal discomfort is always aggravated by the menstrual cycle. A feeling of fullness in the pelvis, and rectal pain, occasionally bleeding from the rectum, is indicative of sigmoid or rectal invasion. The age of the women is suggestive (usually between 30 and the menopause). At times perforation of the ovarian hematoma is followed by acute symptoms suggesting appendicitis. Menstruation is frequently excessive and prolonged; at times metrorrhagia occurs. A constant dull pelvic ache may be present which is always aggravated during menstruation. Vesical symptoms and hematuria indicate involvement of the bladder in adhesions or direct invasion of the bladder wall.

Diagnosis.—The history of acquired increasingly severe dysmenorrhea is very suggestive, particularly if no history or evidence of a pelvic infection can be obtained. Palpable nodules felt in the culdesac or on the posterior surface of the uterus are very characteristic. The cervix should always be exposed and search made for transplants on the vaginal vault or in the rectovaginal septum. With extensive involvement all the pelvic structures become adherent and massive fixation of the broad ligament occurs.

Treatment.—The surgical treatment of endometriosis depends in a large measure upon the knowledge of the course or spread of the lesion, and must frequently be modified by the patient's desire for conservation. Bilateral oöphorectomy would be the method of choice, if the activity of this endometrial tissue actually is dependent upon the ovarian hormone. In general, this has been the procedure followed. Sampson says, "When encountering small areas of endometrial transplants in the ovary, they are excised and also all peritoneal transplants are removed to lessen the chance of further implantation. This is combined with dilatation of cervix and correcting any uterine displacement in women desiring children, or by bilateral salpingectomy when future pregnancy is not to be considered." He emphasizes the importance of carefully exploring both ovaries, especially the under surface, and removal of all transplants to prevent the possible development of ovarian hematomata or even malignant ovarian tumors. The results of ovarian conservation are not uniformly good, although pregnancies have been reported following this treatment.

Graves does not agree with the statement that the tumor invariably develops retrograde changes after removal of the ovaries, although this occurs in the majority of cases. While this is the basis of treatment of adenomyoma of the rectovaginal septum, infinitely safer than a bowel resection, he points out Schroeder's statement in *Lehrbuch der Gynäkologie* that as regards "the eventual shrinking of adenomatous tumors after cessation of ovarian function, experience is lacking." Graves suggests that ectopic endometrial tissue may possess different degrees of clinical malignancy; that some of it may have

passed the bounds of ovarian influence and grow independently even after the removal of the ovarian hormone. In support of this theory is Sampson's observation that peritoneal transplants derived secondarily from chocolate cysts of the ovary are more vicious than those derived from the endometrium or endosalpinx directly.

In the cases where large ovarian hematomata are found, usually densely adherent in the pelvis to the posterior surface of the uterus, tubes and loops of intestines, frequently associated with extensive peritoneal transplants and invasion of the underlying structures, ovarian conservation is attended with great risk of not relieving the patients and, if done, is generally followed by secondary operations. In this group of cases, better results are to be obtained if a clean sweep of the pelvis is made at primary operation and peritoneal lesions are removed as far as possible, or punctured and devitalized by a diathermy point. Kelly [105] has recently pointed out the ease and advantage of so treating immovable transplants from ovarian carcinoma located on the peritoneum or on loops of bowel. Since it has been clinically and experimentally proved that endometrial transplants readily grow in the tissues of the pelvis, it behooves the gynecologist to attempt to prevent this dissemination, especially in the presence of malignant endometrial alteration in the uterus. Sampson has found bits of cancer particles lying in the lumen of the tube in 4 of 7 specimens of cancer of the uterus. Three of the 4 women had had a diagnostic curettage. In view of this finding, he lays down the following rules:

(1) Gentleness in palpating and examining the uterus is essential especially if cancer is suspected. (2) Diagnostic curettage is not without danger and should be done only in doubtful cases and with great care. (3) Radium should not be used as the insertion of the capsule may act as a block and force contents of the uterus into the tubes. (4) In doing a hysterectomy, the fimbriated ends of the tubes should be ligated and the blood-vessels of the ovary, round ligament and uterus should be doubly ligated and cut between ligatures. (In this connection, the cautery knife can be advantageously employed because of its ability to seal off lymphatics and blood-vessels, thereby preventing dissemination of cancer particles or endometrial fragments.)

MALIGNANT TUMORS OF THE UTERUS

Carcinoma in General.—*Etiology.*—Infectious Theory.—On page 357 we mentioned the work of Nuzum as suggesting that carcinoma might be due to bacteria and expressed the hope that the work might be repeated by other independent observers. The theory, however, has received no support. On the contrary, many fundamental objections have been made concerning it. The view that cancer is due to bacteria has been combated recently by nearly all the better known observers who are working in this field. It has been supported by only one observer, Edward F. Smith, of the United States Department of Agriculture, yet his support was theoretical and derived from his study of plant pathology.

At the Lake Mohonk International Conference on Cancer in 1926, Ewing

voiced the sentiment of cancer students of present day when he stated: "At the present day I have no hesitation in committing myself without reservation against this theory (bacterial origin). Together with most general pathologists I regard it as incompatible with the known facts about cancer. The assumption of a universal cancer parasite can be held only by those who assume in addition that cancer is a single disease comparable to tuberculosis. This assumption appears to be untenable. Cancer is not a single pathologic entity but a great group of diseases of varied origin and course."

Wood, and Roussy, at the same meeting called attention to the large number of bacteria, parasites or fungi that have been described as specific etiologic agents in the causation of cancer, and stressed the point that none of these researches has withstood the test of time and nearly all of them have been abandoned and forgotten. Roussy stated that those who at present uphold the infectious theory have a faulty method which consists in isolating a certain factor from a fragment of the tumor or from the product of its grinding or filtration, attempting to cultivate this factor in a specific medium and, finally, trying to produce a tumor by animal inoculation.

Heredity.—In our monograph we have stated our belief that heredity is one of the etiologic factors in cancer and have urged that its importance is not generally considered because a false value is usually ascribed to the family histories which are taken in the ordinarily good American hospital. The "family history" in such institutions is of little value in our eyes because patients in the United States are not familiar with the causes of death of enough of their antecedents to make the record of any value: nor is the history usually taken by physicians mature enough to record the family history in a manner which shows just how little or how much the patient knows about their family history. Instead of recording such data, the history is most likely to be "negative for carcinoma," or else cite single cases without other necessary data. Gideon Wells states that statistical evidence in literature of the present time concerning the influence of heredity on the occurrence of cancer may be dismissed from consideration, and must remain of no value until there are necropsy records of all persons dying in several generations of the same family.

The influence of heredity as a causal factor of cancer has been impressed upon us by the family history of a considerable group of cancer patients who have been acquainted with the death causes of a large proportion of at least three generations of their antecedents. These observations cause us to see three groups of families of several generations which present as follows:

1. Those in whom cancer is practically never seen.
2. Those in whom cancer occurs in its normal frequency.
3. Those in whom cancer occurs so frequently that they may be regarded as cancer families.

The opinion is forming that the hereditary influence of cancer is best expressed as the fact that a child of a cancer family is not born with a pre-

disposition to the tumor as much as it is born without the normal immunity against this disease.

While it is undoubtedly true that we cannot apply directly to the study of human cancer the observations which have been made in the malignant tumors of mice and other experimental animals, it is a fact believed by all who have followed the brilliant work of Maud Slye that the heredity influence of cancer is firmly established in mice.

Chronic Irritation a Predisposing Factor.—The view that chronic irritation is a factor which predisposes to cancer amounts nearly to the same thing as the inheritance of predisposition to cancer, since we cannot overlook the fact that all human beings are subjected to the same or similar chances of chronic irritation or trauma. Maud Slye's observations in mice support this belief since she finds that while local trauma occurring in individual mice without hereditary predisposition to cancer rarely results in the development of a malignant tumor, in cases in which the predisposition is well marked local trauma very frequently resulted in the development of a tumor. Most interesting was her discovery of a hereditary predisposition to cancer of certain organs or certain parts of the body. In a family of mice in which a large percentage had died with cancer of the breast, local trauma to the breast resulted in the formation of a cancer of the breast while local trauma to other parts of the body failed to produce a tumor. Likewise, in another mouse family with a predisposition to cancer of the mouth, injury to the mouth resulted in the formation of a cancer of the mouth, while local trauma to other parts of the body was not followed by a tumor. These remarkable observations impress us with the fact that there are two factors of equal importance in the production of cancer: First, predisposition, either inherited or acquired; and second, a local factor in the form of chronic irritation or trauma.

The Mohonk Conference agreed, among other things, on an official statement from which the following are quoted:

1. The causation of cancer is not completely understood, but it may be accepted that for all practical purposes cancer is not to be looked upon as contagious or infectious.

2. Cancer itself is not hereditary, although a certain predisposition or susceptibility to cancer is apparently transmitted through inheritance. This does not signify that because one's parents or parent or other members of the family have suffered from cancer, that cancer will necessarily appear in other persons of the same or succeeding generation.

3. The control of cancer, so far as this subject can be understood at the present time, depends upon the employment of measures of personal hygiene and certain preventive and curative measures, the success of which depends upon the intelligent coöperation of the patient and physician.

4. Persons who have cancer must apply to competent physicians at a sufficiently early stage in the disease, in order to have a fair chance of cure.

5. The cure of cancer depends upon discovering the growth before it has done irreparable injury to a vital part of the body and before it has spread to other parts. Therefore, efforts should be made to improve the method of diagnosis in its various locations and the treatment of cancer so discovered.

Dedifferentiation of the Cell.—This theory has been warmly advocated by Blair Bell recently. Like a number of other hypotheses, it is based upon cell autonomy. It starts with the theory that the normal cell grows under certain restraints which include (1) tension of the surrounding tissues, (2) changes incidental to nutrition, (3) the necessity of function, and (4) the purposeful control of the organism, and holds that cells emancipated from these growth restraints, *i.e.*, cancer, are merely exhibiting their natural capacity when they grow wild. Many irritative factors such as mechanical trauma, radiations, heat, irritating chemicals, etc., upset the cell balance necessary to proper cell life. Some cells die under its influence, while others are so badly hurt that, when they recover, they do not return to their former condition of complete differentiation but become dedifferentiated into a primitive type since only in that phase do they find conditions under which they may live. Pathologists in general regard cancer cells as undifferentiated tissue. Bell feels that they are dedifferentiated from more highly complex cells and considers that cancer cells are closely akin in type to the trophoblasts of early chorionic villi. Syncytium provides its own nourishment, grows rapidly and has a normal tendency to invade surrounding tissues, but the invasive tendency is checked by some biologic hormone developed by the body because the chorion is a purposeful organ. Such a restraining influence is absent in cancer since this growth is purposeless. Bell feels that the analogy of malignant cells to chorionic tissue is shown morphologically by the tendency to syncytial arrangement and by the invasion of blood-vessels. Chemically both the cancer cell and the trophoblast show a higher phosphatid-cholesterol ratio than the normal cell, thus demonstrating the necessary prerequisites for cell-membrane permeability and rapid growth. The theory has been supported by Warburg from a physiological standpoint, who proved that malignant cells obtain their energy by glycolysis in contrast to the oxidation method of normal tissues. Both Blair Bell and Murphy of the Rockefeller Institute have shown that the chorionic epithelium behaves in an identical manner. Toxicologically, malignant and chorionic tissues both show the same reaction of coagulation necrosis to lead. Clinically, it has been said that lead workers are extremely likely to abort because of injury of the chorion caused by lead absorption, also that sufferers with chronic lead poisoning do not develop cancer.

The authors, however, doubt if there is yet sufficient data to warrant any definite statements concerning lead poisoning and cancer. Tillman, in 1927, attempted an investigation of this character, using for the purpose the records of the Presbyterian Hospital of New York City. He found that there had been only 26 cases of lead poisoning in the hospital during the last twelve years. Yet there were 3 individuals who gave a definite history of former lead poisoning among the 441 cases of cancer which he reviewed in the same institution. In the same series there were 21 individuals who had cancer and in people who had worked in lead at some time as painters, plumbers, typesetters, etc., 2 of them gave a history of a former lead poisoning.

Increased Frequency of Cancer.—Nearly all cancer statisticians emphasize the fact that cancer appears to be on the increase. Hoffmann, whose statements

are based on an endless amount of statistical data, stated in 1926 that while the mortality from nearly every other important disease has been decreasing during the last twenty years, the cancer death is rapidly increasing. The authors feel that, while this is an undoubted fact, the physician must bear in mind that cancer is one of the diseases that normally cause death in the aged and that undoubtedly the great reduction in the mortality of other diseases in youth and middle age permits a larger number of survivors than have been found at any other era in history, many of whom will die late in life with cancer which in the aged is one of the normal expectancies. In contrast to this view, the great interest attached to the increased frequency of cancer concerns cancer in comparative youth at which time the disease should not be a normal expectancy. Hoffmann's statistics indicate that, previous to the Civil War, medical reports from the southern sections of the country showed a relative infrequency of cancer among the slave population. Cancer of the uterus was even stated to be practically unknown among them. At the present time, however, the cancer death rate of our negro population closely approaches that of the white population in many sections of our country. In the year 1922, for illustration, the cancer death rate among whites in Louisiana was 80.7 per 100,000 population, while that of the colored was 68.7; in Kentucky the white rate was 55.6 and the colored was 57.3; in Mississippi the white rate was 58.6 and the colored 53; in North Carolina the white rate was 57.4 and the colored 57.5. The report by Dublin, Kopf and Van Buren of the cancer mortality in the wage earners and their families who had been insured by the Metropolitan Life Insurance Company from 1911-1922 gives data along the same general lines. It shows that heart disease, tuberculosis, Bright's disease, and pneumonia alone outranked cancer in numerical importance. It also shows that a child that has reached the age of 10 years is more apt to die ultimately from cancer than from tuberculosis or pneumonia. The death rate which they report was practically stationary during the twelve-year period for cancer of the female genitalia, although there is a definite rising tendency in both white and colored women in the age group from 65 to 74 years. In their report they state that eleven-twelfths of the malignant diseases of the female genitalia in white women was in the uterus while 97 per cent of such malignancies in colored women were in the same organ.

Carcinoma in Orientals.—Wieberdink,[106] in 1927, criticizes the official statistics in regard to carcinoma. Its rarity in tropical countries is, in his opinion, partly illusory. He presents detailed hospital statistics, showing 175 tumors (the great majority malignant) among 9660 patients. Carcinoma of the breast, which has been said not to exist in the East Indies, was present in 10 patients, 6 of whom were natives, 3 Chinese and one a European. One of the Chinese was a man, the rest of the patients were women. He deplores the tendency to assume that a patient has one of the common tropical diseases unless it is proved by a thorough examination. In ten years he has seen only one operable carcinoma of the rectum. All the others had been too long under treatment for dysentery. Many recent investigators have shown the high incidence of carcinoma among the Japanese. It will be remembered

that earlier textbooks emphasized the infrequency of cancer in the Orientals. The above shows that no weight can be attached to the older teaching that carcinoma is infrequent in races not belonging to our Western civilization.

Carcinoma of the Cervix.—*Cervical Carcinoma in the Young.*—Medical literature contains many isolated cases of carcinoma of the cervix in young women. We have met with no compilation of size. Aguinaga,[107] in 1925 in Rio Janeiro, reports a girl of 14 with a vegetating tumor of the cervix which, on section, proved to be carcinoma of the cervix. Bonner,[108] in 1927, reports a basal-cell cancer of the cervix in a girl of 12 years, who was living two years after treatment with radium and Roentgen ray. Heusinkveld,[109] in 1925, reports a girl in Iowa who died at 20, five years after an operation for adenocarcinoma of the cervix. There are a number of similar reports. Others have presented single instances of cervical cancers in women in their twenties, apparently ignorant of the fact that the literature of the medical world shows that from 3 to 7 per cent of all cervical cancers occur in women under 30 years of age. In James West's [110] reports in 1927, 5 per cent of the 200 cervical cancers in the New York Post-Graduate Hospital were under 30 years.

Cervical Carcinoma in Nullipara.—In the monograph we stated, on page 183, that carcinoma of the cervix rarely occurred in virgins or women who had not had birth trauma or some pelvic condition which had been treated by dilatation of the cervix. In proof of this, we cited the report of Sampson whose 412 carcinoma from Kelly's clinic contained only 3 per cent of nulliparæ, while Williams, in England, found nulliparous cancer in only 4 per cent of his 334 cases. We did not stress at the time Cullen's series, largely because it contained only 83 cases, yet in this group there were 50 cases of squamous-cell carcinoma of the cervix, 5 of whom had not borne children; in 14 cases of adenocarcinoma of the cervix there were 2 nulliparæ, while in 19 cases of adenocarcinoma of the body of the uterus, 2 were unmarried and 6 of the 17 married women had never been pregnant. Since then Martzloff [111] (1926) reported 387 cases from the Johns Hopkins Clinic (many of whom had been included in Sampson's and Cullen's report), 5.4 per cent of which denied pregnancy at any time or vaginal instrumentation. As our individual series of cancer of the cervix has been maturing, we have been constantly impressed with the high percentage of cervical cancer patients who have never been pregnant. In our series of 107 cases whose five-year end results were reported in 1927, 17, or 16 per cent, had never been pregnant; several were virgins. Graves,[112] in an article read before the British Obstetrical Society in 1927, reported 50 nulliparæ in 538 carcinoma of the cervix (9.3 per cent). James West, in 1927, in reporting 200 cases of carcinoma of the cervix at the New York Post-Graduate Hospital, found that 26, or 13 per cent, of them were single, while 58 cases, or 29 per cent, of his total series had never been pregnant. This includes the single and the sterile married. Stewart and Young,[113] in 1926, found that 10.8 per cent of their 176 patients with cancer of the cervix were nulliparæ. It by no means follows, however, that because a woman is nulliparous that the cervix is free from chronic irritation. Gonorrhea is the most common cause of sterility in women. Even virgins may present chronic

irritation in the cervix. Vaginal erosions are frequently seen in virgins whose uterus is markedly displaced; congenital ectropion is common; a certain amount of atresia of the cervical canal is not infrequent, nor are fibroids; while many virgin women have senile vaginitis after the menopause. Moreover, such data must be considered in relation to census data which give the proportion of married and unmarried women in the cancer age. The report of O'Brien,[114] in 1925, emphasizes this point in his survey of 500 uterine cancers, 406 of which were cervical epithelioma. O'Brien states that the 1920 census shows that only 9.71 per cent of women over 35 were unmarried and that only 7.4 per cent of women in the second decade of married life had never been pregnant.

Cancer Individuals Seem to Develop Other Cancers.—When the monograph was written, the one outstanding report which emphasized this fact was that of Weibel,[115] read before the International Congress in London in 1914. His data comprised 169 cases of Wertheim's series which had been followed for a minimum of six years, 13, or 7.7 per cent, of which developed cancers from six to eight years after operation; one of these was in the duodenum, one in the breast and one of the clitoris. While the casual observer might feel that the latter might be a metastasis, the microscopic picture of all of the secondary tumors was so different from that of the original tumor that they were believed to be new cancers. The total remaining 10 cases were undoubtedly recurrences in the pelvis. We have seen no similar reports in the five years intervening since the monograph went to press, possibly because few surgeons are able to keep their cancer series under observation for more than the five-year period which is the minimum which should be accounted as a cure. Several isolated reports have appeared in recent literature of other cancers that have developed in women whose pelvic cancer had been considered cured. Gabastou's [116] report in 1926 concerned a woman of 44, who, three years before presenting with an epithelioma of the cervix, had had a cystadenoma of the ovary completely removed. Iribarne,[117] in 1926, reported from Buenos Aires a case of operable cervical epithelioma which had been cured for six years by radium when she again presented with an adenocarcinoma of the bowel.

Cancer of the Cervical Stump after Supravaginal Hysterectomy.—The fact that cancer may be developed in the cervical stump after supravaginal hysterectomy for fibroid or ovarian tumors has made an interesting subject for recent discussion. On page 355, we quoted the report of the Pennsylvania State Cancer Commission in 1924 which showed that of 268 cervical cancers cited by them, there were 9 which developed in the cervix after supravaginal hysterectomy. Isbruch,[118] writing from Mackenrodt's clinic in 1926, described 2 such cases and cites 65 similar ones on record in German literature. Hochman,[119] in 1926, reported 1114 supravaginal hysterectomies in which he stated that there were only 3 which subsequently developed carcinoma of the cervical stump. The same author, in his series of 263 cases of cancer of the cervix, had only 7 which had had a previous supravaginal hysterectomy for a nonmalignant condition. Masson,[120] in 1926, reported 10 carcinoma in the cervix

seen during 1921 to 1926 that followed from three to fifteen years after supravaginal hysterectomy for benign lesions, and 19 in whom it could not be ascertained whether the previous operation had been done for a benign or malignant condition. Wille,[121] in 1927, again discussed this question and reported an early carcinoma of the cervix four months after a double ovarian cyst had been removed when a supravaginal hysterectomy was done. We feel that the carcinoma in this instance might have been present as an unrecognized lesion at the time of the operation but the case is of interest in that she remained well six and a half years after the secondary operation. While there has been no comprehensive review on this subject by recent American investigators, nearly all teaching men in this country agree that a supravaginal amputation of the cervix for a non-malignant condition does not necessarily render the individual more likely to have a carcinoma develop later in the cervical stump. They feel that such individuals present cancer in the stump only in the same percentage that would have occurred had they not been operated for some other condition. This point, however, has not been proved.

Carcinoma Rarely Develops after a Cervical Repair.—Graves,[122] in 1927, stressed this point and states that in a follow-up of 4815 cervical repairs, including trachelorrhaphy, amputation and cauterization, he was able to find only 7 cases that developed cancer of the cervix. In 3 of these cancer probably was present at time of operation but had been overlooked by the pathologist. In 2 others, the plastic operation had been injudiciously performed and had been followed by an obstructing stenosis of the upper vagina and cervix which, in itself, furnished a predisposition for the development of a cancer.

Relation of Histology to Prognosis in Cervical Cancer.—Most authors have divided squamous-celled carcinoma into three general groups because the majority of cells presented one of the following histologic pictures:

1. Fat spindle-celled, which corresponds to the cells of the deepest layer of the squamous epithelium and is long and comparatively broad.
2. Transitional, which corresponds to cells of the middle zone of the original epithelium, is round, has a definite outline and a nucleus that stains deeply.
3. Spinal-celled, which is similar to the cells of the outer layers, it being polyhedral in shape with a well-defined cell outline and a nucleus which stains moderately well.

On page 358 we cited the work of Broders, Martzloff, Pomeroy and Strauss, all of whom felt that there was a definite relation between the histomorphology of the predominant cancer cells and the degree of clinical malignancy.

Martzloff, in 1926, again stated that the histomorphology of the predominant type cells in epidermoid cancer of the cervix is important since the spinal-celled type of cancer proved to be the least malignant, the transitional next in order of increasing malignancy and the fat spindle-cell type proved to be the most malignant. Pemberton,[123] in 1926, reports a study which agrees

in principle with Martzloff's conclusions. Kimbrough and Charles Norris,[124] in 1927, also agreed. Schmitz, Hueper and Arnold,[125] writing together in 1926, have accepted Schottlander's classification as did Fluhmann [126] in 1927. Each group of authors felt that an immaturity of the cells and a low degree of differentiation and a high degree of anaplastic changes are all indicative of a high malignant index, while the greater the maturity of the cells, the higher their differentiation and the less their anaplastic changes, the lower will be the malignant index. Healy and Cutler, in 1928, agree with this principle, and present their tables. Plaut,[127] in a study of cervical carcinoma in the Woman's Hospital in New York, followed Martzloff's methods and classification and does not believe that the histologic picture of cancer of the cervix as known at the present time permits us to establish more definite groups based on the type of the cancer cells. With him the authors absolutely agree and feel that many other factors besides the foregoing must be considered in determining the prognosis. Thus it is well known that many individuals have greater resistance than others and that this factor may cause the growth to develop more slowly; nor do we know as yet anything concerning the influence of age upon the growth of the tumor. Moreover, the authors feel that much of the work cited above should not be considered as undisputed evidence since nearly all save Martzloff have included in their statistics all the cases of carcinoma from which sections have been taken and have not limited their study to the cancers which had been removed completely at operation. In this type of study, we feel that one must restrict the microscopic study to the advancing edge of the tumor because sections taken from different parts of the tumor show different proportions of the various types of cancer cells. From one section the pathologist may conclude that fat spindle-cells are the predominant type, while from another section taken from a different part of the same tumor, transitional cells may appear as the more numerous. For these reasons, we do not feel that a section which is removed from the vaginal aspect of a large mass which jams the pelvis is going to tell us with any certainty what type of cell lies higher in the midst of the mass or in the advancing edge of the tumor. In our own study of specimens that were removed by a very radical operation, we were often unable to definitely determine the predominant cells even when the study was limited to the growing edges of the cancers. Others must have had the same difficulty. There is always the temptation to classify as transitional cell type the cases concerning which there is doubt. For these reasons, we feel that the work cited above, while most interesting, is by no means actually conclusive. Martzloff, in 1928, has modified his opinion only to the extent that in about one-third of his cases the biopsy material did not reflect correctly the predominant type of cancer cell in the uterus after removal.

Cure of Cervical Cancer.—What Constitutes a Cure.—Cancer may recur so many years after operation (Bumm cites a recurrence twenty years after, Ries one nine years after) that any time limit as to what constitutes a cure is more or less artificial and arbitrary.

Three-Year Cure.—In the earlier days of surgery three years freedom from recurrence was considered a cure. This was adopted first for cancers

of the breast and later for cancers of the uterus. Follow-up work, however, soon demonstrated that too many cases of carcinoma of the cervix presented recurrences under a longer follow-up to make this time limit acceptable as a proper definition of a cure. While a few cancer students, disappointed in their efforts to maintain a longer follow-up, have again urged the adoption of the three-year cure, the unreasonableness of the contention is shown anew by the following: Ward,[128] 1925, 147 cases, three-year absolute cures, 44.8 per cent; five-year absolute cures in same series, 25.9 per cent. Philipp and Gornick [129] (Bumm's clinic), 1926, 805 cases, three-year absolute cures, 20.75 per cent; five-year absolute cures in same series, 15.27 per cent. Lynch,[130] 1927, 107 cases, three-year absolute cures, 27 per cent; five-year absolute cures in same series, 16.3 per cent. Moreover, in our own series there were more late recurrences after radium treatments than after operation as shown by the following table:

Percentage of Cures

	Number of Cases	After Three Years, per cent	After Five Years, per cent
Radium in operable cases	5	100	20
Radium in inoperable cases	59	20	8.5
Radium as prophylaxis or after suspected recurrence following hysterectomy	23	10	0
Radium after known recurrence following cervical resection	2	100	100
Radical operation, with and without preoperative or postoperative radium	17	76	47

Five-Year Cure.—Due largely to the work of Winter, the gynecologic world in 1908 accepted five years freedom from recurrence as a more proper definition of a cancer cure. Cancer can recur later but it rarely does so, and there are too many difficulties in keeping patients under observation for a longer period to warrant extension of the time limit to six or seven years. If patients did not die from old age or intercurrent diseases during a long follow-up, seven years would be a more proper time limit for cure. Yet they do die from such causes. The five-year follow-up is as long as is reasonable because there is as yet no agreement how we should classify either the cases which escaped the follow-up or died from old age or intercurrent disease before the five-year follow-up has been completed. No matter whether such cases are excluded from all compilations just as if they had never been treated (unless they had recurrences when last seen when there would be no doubt how to list them), or whether they are listed as recurrences on the ground that the disease is more likely to recur than to be cured, there is no doubt that the value of a report of end results is tremendously impaired by the exclusion of any cases whatever. The literature shows that only a small percentage of recurrences develop after five years, and that it is not as likely to be regional as it is to be in the pelvic lymph glands. Winter, in 1908, stated that in his series of 350 cases, there were only 2 that positively and 2 that possibly de-

veloped recurrences five years after operation. He reviewed the literature which showed that not more than 10 of 1000 recurrences developed after five years. Now, however, the percentage is known to be much greater. Seitz found 3 per cent of the recurrences in von Winckel's clinic in the fifth year. Peterson, in 1920, tabulated his 14 recurrences after operation. Two occurred in the fourth year and one in the sixth. Bonney, in 1921, studied 33 recurrences, 2 of which occurred after five years. Weibel, in 1914, found 7.7 per cent of such recurrences in Wertheim's 169 cases that had been followed from six to eight years after operation. Of these 13 recurrences, 6 developed in the sixth year, 5 in the seventh, and 2 between the seventh and eighth years. In 1925, Weibel, in a study of the 1000 cases that had passed the five-year period of observation in the Wertheim and Weibel clinics, found that 5 per cent of the recurrences occurred in the fifth year. Werder, in 1913, showed that there were recurrences five or more years following hysterectomy by the cautery method. The removal, naturally, was not as wide as the more modern radical operation. He had 8 recurrences developing from five to nine years in the 87 surviving operation. Bumm's table is of great interest in showing the survivors after treatment. Yet it does not show the frequency of late recurrences alone, since all deaths after operation from whatever cause, whether old age, intercurrent disease, or from recurrence of disease, are charged against the treatment as return of cancer. We present our condensation of it on the following page.

Absolute Cures.—Many cancer students of the present time lay undue emphasis upon their absolute cures. Absolute cures are the percentage of all the cases that applied for treatment and remained cured for an accepted period of time. The percentage depends upon the relative proportions of early and late cancers that exist in the series. The per cent of absolute cures may be meaningless in any series unless the results of treatment are also given for each individual group of similar cases. Absolute cures were the important consideration when surgery alone offered any chance of cure. The detailed classification of cases was a minor matter since there was no clear-cut definition of what constituted an operable case. Some men attempted to operate all but the evident hopeless cases, while others treated only fairly early cancers. The results of two such men could not be compared except in terms of absolute cures.

Surgery has failed to cure any but the early cancers. Radium, on the contrary, is of value in the treatment of nearly all types of cases. The advent of radium as a therapeutic method has made necessary a more detailed classification than was needed when surgery only could cure. Unless cures are properly tabulated, we cannot contrast the results of different methods of treatment. Many classifications have been proposed. The following is the one recommended by the American College of Surgeons, which is now generally adopted in the United States:

Group I is comprised of the carcinomata that are clearly localized in the cervix (operable cases).

SURVIVORS AFTER TREATMENT IN BUMM'S CLINIC: NO EXCLUSION FOR CASES LOST OR DEAD OF INTERCURRENT DISEASE
Series Includes All Cases, Operable, Border-Line, Inoperable, Treated by Surgery, Radium, or Radium and Roentgen Ray

Year of Treatment	Number of Cases Treated	Free from Recurrence in											
		1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925
1913	78	27	21	17	11	11	10	10	10	9	9	9	8
1914	77		36	20	17	10	10	9	9	9	9	9	9
1915	127			61	42	37	33	31	27	27	27	27	27
1916	175				78	44	34	32	25	25	24	24	24
1917	145					47	26	21	15	13	13	12	12
1918	114						41	29	19	15	13	11	11
1919	89							50	29	22	21	20	20

Group II contains the late operable or border-line cases which exhibit only a suspicion that the immediately adjacent tissues may have slight invasion. There is no definite invasion although the paracervical tissues are doughy or of swollen consistency.

Group III contains the cases ordinarily considered inoperable, presenting evidence of invasion of the parametrium and contiguous tissues although the parametrium is not completely fixed.

Group IV contains the late inoperable cases which show such an extensive involvement that the tumor is in a "frozen pelvis."

Many radium students attempt comparison of the results of surgery and of radium expressed in terms of absolute cures. Such a comparison is impossible. Surgery never has cured any late cases, as is implied by the term inoperable. Radium, however, cures a few. A logical comparison of results is proper only in operable cases, since in these only either agent may cure.

Comparison of the results of radium and truly radical surgery only is proper because the ordinary panhysterectomy rarely if ever cures. We feel that the surgeon who operates even an early cancer of the uterine cervix by a simple panhysterectomy offers nothing to the patient but, on the contrary, deprives her of a reasonable chance of cure by either truly radical surgery or else by radio-active rays.

Radium Rather Than Surgery in the Treatment of Operable Cervical Cancer.—On page 359 is summarized the radium literature claiming that radium has cured a small percentage of inoperable cervical cancers, more border-line cases than does surgery, and nearly as many operable cases as surgery has been reported to do. This salvage was obtained with a small primary mortality of 2 per cent or 3 per cent, did not require a prolonged hospital stay, and was followed by comparatively little disagreeable post-radiative complications. The radium literature up to 1925 urged that the technic of radium treatment is constantly improving and stated that the results obtained at present time are by no means as good as will be obtained the next few years with improvements in technic that are bound to follow, and especially if the radium treatment is supplemented with deep Roentgen-ray therapy. For these reasons, its advocates felt that surgery should be abandoned in favor of radium in the treatment of cervical cancers.

We felt that these contentions would prove true only in case the radium treatment was conducted by one skilled in its application and that the surgical treatment was in the hands of men who were not doing truly radical surgery limited to the localized growths alone. Any one who has developed himself as a radiologist knows full well that it has not always proved harmless to his patients. Moreover, he should have ample equipment. W. J. Mayo well said that it is quite possible for a physician with a nickel's worth of radium to do a million dollars' worth of harm. Yet if a surgeon attempts to remove the cancer by the ordinary abdominal or vaginal hysterectomy there can be no doubt whatever that the case would have been far more successfully treated only by radium followed by deep Roentgen ray. The treatment of cancer

should be based on facts known at the time the patient comes for treatment. The known facts when the monograph was written showed that surgery offered the best chance of cure. Nor in 1925 were we at all convinced that the case had been proved that radium should supplant truly radical surgery in the hands of a competent operator. We based the opinion on our own experience together with a critical review of the literature. We ourselves at that time had treated 7 truly operable cases with radium alone, and had seen recurrences develop in 5 before the expiration of four years, in spite of the fact that the cancer area in 2 of these was extremely small and appeared to be limited entirely by cervical tissue. The cases had been treated by the radium technic that we had been using in all of our cervical carcinomata, which a year later was found to have cured for five years 5 of 56 of our inoperable and late border-line cervical cancers (9 per cent cure). Naturally, we were not enthusiastic about the results in the operable cases treated by radium since we personally had obtained far better results by our surgery (47 per cent five-year cures). The literature showed that others had had similar failures in treating operable carcinoma with radium. Heyman,[60] while curing by radium 16.6 per cent of 181 inoperable cervical cancers in the Radiumhemmet in Stockholm, was able to cure for five years by the same agent only 8 of 19 operable tumors; Clark, who had already abandoned surgery for radium in operable cases, cured only 5 of 22 cases, a total salvage for these two well-known clinics of less than 31.5 per cent.

When we reviewed the radium literature at that time, we could find record of only 150 operable cervical cancers that had been radiated and not operated at least five years prior to their report. This series appeared too small for any one to draw definite conclusions. Moreover, the percentage of cured varied tremendously in reported cases, ranging from 27 per cent for the series of Clark, and of Bailey, to 80 per cent for Doederlein and 100 per cent for Schmitz' 3 cases. Detailed study of the reports showed that with the exception of the Doederlein series, the maximum number of cases in any one series was 22; the majority being under 10, a series quite comparable in size to that treated by ourselves. Thus, Seitz reported 8 operable cases with 4 cures; Beuttner, 9 operable cases with 4 cures; Clark, 22 cases with 5 cures: Schmitz, 3 cases with 3 cures: Doederlein, 43 operable cases which he called "completely radiated" with 35 five-year cures, and 34 operable cases "incompletely radiated" with 15 cures, or a total of 65 per cent of five-year cures for his combined series. Had others equaled Doederlein's results, we felt that there would be no question as to the superiority of radium over surgery. Others, however, had not approached these results (nor have they been equaled since by others or in his own clinic, which later reported 147 operable cases radiated with 64 five-year cures, or 43.5 per cent). Deducting the Doederlein series from the computation, which it seemed reasonable to do, there remained in the literature, which was urging that surgery be abandoned, only 72 cases from which to draw conclusions, a series too small to convince any one critically inclined. The 72 cases were reported by Seitz, Beuttner, Heyman, Bailey and Healy, Clark, and Schmitz, with only 27 cures, or 37.5 per cent. These statistics were

gleaned from a perfectly tremendous radium literature which seldom presented definite facts as to what had been obtained by treatment, since most authors reported their results as from six months to two- or three-year cures, after grouping indistinguishably cervical and fundal cancers. Altogether the literature appeared entirely too scanty in actual facts to do more than stimulate the hope that radium might prove a most useful method of therapeutics. Yet we found many points which created in our minds doubt for the future of the therapy. The fact that radium, which cures from 5 per cent to 15 per cent of inoperable cases for five years, failed to approach the cure of even half of the operable cases compelled our attention. It suggested that there is more to the cure of cancer by radium than the destruction of the tumor by the element alone. No one can believe that inoperable cancers are cured solely by the direct action of the radium upon the cancer cells, since there are always cancer cells in these cases that lie far beyond the reach of the active rays. It does not seem reasonable to us that radium cures depend upon the strangulation of cancer cells by fibrosed cells which develop as a necessary sequence of radiation. Were it true, large doses of radium should cure 100 per cent of local growths, the so-called operable tumors. The element would also fail to cure any inoperable tumors which have metastases far distant from the primary tumor. Even assuming that the cancer patient gains strength quickly after she has been relieved of the burden of an infected ulcer, there remain valid reasons for the idea that a protective substance develops in the body in reaction to the cancer itself, and that this aids in marked degree the destruction of the cells which lie beyond the reach of the active rays; and that nature has not yet developed this protective mechanism in the presence of small and early growths which did not present the picture of an infected ulcer.

A year and a half later, we again reviewed the question and felt that it was by no means proved, even at that time, that radium should then supplant truly radical surgery in the treatment of operable cancers of the cervix, provided the case was in either expert radiological or surgical hands. If it was not in such hands, we felt that there was no doubt that the patient had best be radiated. We were much interested in three major points during our review of the literature:

1. There is always difficulty in judging any group of statistics since what may appear as a circumscribed lesion to one man may constitute an entirely different picture to another. Yet, even with this premise, it did not appear to us that operable cases reported in surgical statistics were identical with those reported as such by the radiologists for the following reason: When surgery was the only therapeutic agent that offered the patient chance of cure, the surgeons attempted without result to develop an operation so radical that even the late cancers could be operated with some chance of cure. Cancer students attempting to establish definitions that would permit comparison of the surgical results from different clinics had agreed that a case should be classed as operable if the operation had been completed and not abandoned, irrespective as to whether the removal was complete or not. Therefore, included in the surgical cures as operable cases, were a number of inoperable

cancers that were classed as operable only because the operation had been completed, even though it did not offer hope of cure.

Proof of the above is seen in the table on page 394, which shows the proportion of the cancer material that was operated in German clinics, the high point being 77.1 per cent (Franz) and the low point 38.2 per cent (Philipp). The frequency of truly operable cases (Group I) in America is shown by the following: Lynch, 1926, Group I, 18 per cent. Groups I and II, 27 per cent; Schmitz, 1926, Group I, 5 per cent. Groups I and II, 17 per cent: Norris, 1926, Group I, 17 per cent; Keene, 1926, Group I, 6 per cent; Peterson, 1927, Group I, 9.5 per cent; Healy, 1927, Group I, 12 per cent, etc. The proportion the truly operable cases made with those operated cannot be determined without a survey of the individual cases. On the contrary, the reports of operable cases treated with radium contain few more extensive growths than those that were truly operable, the exceptions being the cases in which there was diagnostic error; the reason being that since radium has come into general usage, there is a more detailed classification of cancer than existed when surgery alone offered cure and cases were either potentially operable or inoperable. If surgery and radium had equal values as therapeutic agents in treating operable cases, the results of radium should be superior because all surgical series of older times contained more inoperable cases than did the radium series of the present time for reasons just cited. The radium cures at that time, however, had not yet equaled those of surgery, as is shown in the next paragraph.

2. We collected from the literature 308 operable cervical cancers that were radiated and not operated with 40 per cent five-year cures, and 2103 cases that were radically operated with 42.1 per cent cures. These series might be cited as showing equal cures, yet the difference between them is not 2.1 per cent as first appears, but is in reality 5 per cent, as is shown by the following proportion: 42.1 is to 40 as 100 is to 95. Nearly any patient would willingly submit to a radical operation to gain 5 per cent of chances over an otherwise inevitable cancer death.

3. The literature seemed to show how a modern man might gain a greater salvage of cases by a more proper combination of radium and surgery and use both methods. The 2103 cases that were operated and not radiated were treated almost entirely before radium had come into wide use as a therapeutic agent. It represented more than half of the cases that applied for treatment in the various clinics while the series was maturing. The other half were necessarily abandoned to a cancer death. Since few cancer series have more than 20 per cent of truly operable cases and most series have less than 10 per cent, it is evident that these 2103 cases included many early and late border-line cases which even then were well known to furnish most of the surgical mortality and fewest of the cures. Had operation been restricted to the early growths, the mortality would have been far less than obtained in the total series, 17 per cent. Had the border-line cases been radiated and not operated, there would have been more cures and few operative deaths—altogether a very considerable increase in total salvage. This seems most rea-

sonable because no radium series has yet reported as much as 60 per cent of cures in the operable cases, while truly radical surgery has done much more. The highest salvage by radium of all the operable cases, including the very early growths as well as those which were limited to the cervix, is 55.6 per cent (Eymer [139] reported, in 1925, 63 cases with 35 five-year cures). On the contrary, Weibel cured by surgery 87 per cent of his incipient cases and 53 per cent of his operable cases that remained after the exclusion of his incipient cases. Von Franqué cured 80 per cent of his earliest operable cases, a percentage that was also equaled by Faure. Bumm cured 49 per cent for six to eight years, or 77 of the 157 operated, and Wertheim (older series) reported 160 cases alive and well out of 380 who were operated five or more years before (43 per cent).

In the summer of 1928, we again investigated the literature which clearly shows that radium as yet has failed to cure as many cervical cancers as has truly radical surgery in the leading gynecologic clinics of the world. This is shown by Heyman's tables in 1927, although this author argues to the contrary. He tabulates 5806 cases who applied for treatment who were operated when possible with 19.1 per cent of absolute cures (the proportion of all applying for treatment who remained cured for five years), as against 3512 cases treated with radium with 16.3 per cent of absolute cures. The difference between them is not 3 per cent as would at first appear, but is in reality 15 per cent as shown in the following proportions: 19.1 : 16.3 = 100 : 85.4.

Nor has radium as yet cured as many operable cases as the radical Wertheim operation has done, as may be seen from the table on page 396. In this is collected all the operable cases only with efficient follow-up that we can find in the literature, 646 cases with 36.5 per cent of five-year cures. As opposed to this there are 3239 cases treated by the Wertheim operation with 40.5 per cent of five-year cures. The difference is considerable. It is far greater than that shown by the proportion 40.5 : 36.5 = 100 : 90, because the operable cases that were radiated represent only 17 per cent approximately of the total cases of the series, whereas the Wertheim cases represent approximately 47 per cent of the cases applying to the surgical clinics. This difference can be reconciled only on the ground that when surgery alone offered hope of curing cervical cancers, all women were operated who had even a faint chance of cure, a condition which no longer obtains. Since few, if any, cancer students have ever seen 49 per cent of Group I cases in a series of considerable size, we feel justified in saying that included as operable cases in the surgical results are all the cases that were treated surgically, viz., all the operable and border-line cases and also many early inoperable ones. Contrasting the surgical results with those obtained by radium in operable and border-line cases we have 40.5 per cent of 3239 surgical cures as opposed to 31.3 per cent of cures in 1260 cases treated by radium. The difference is shown by the proportion 40.5 : 31.3 = 100 : 77.3.

It may be urged with some right that series at the present time may not properly be compared because many clinics treat by surgery nearly all early

FIVE-YEAR CURES AFTER WERTHEIM RADICAL ABDOMINAL OPERATIONS. NO DEDUCTIONS

Reported By	Year	Total Cases Seen During Period of Investigation	Number of Operations	Per Cent of Operable Cases in Total Series	Number of Deaths Due to Operation
Ries [145]	1911	17	13	81	6
Wilson [146]	1914	98	32	32.5	9
Doederlein [147]	1917	265	167	63	32
Bumm [148]	1919		157		21
Cobb [149]	1920		35		5
Mayer [150]	1920	545	343	64.8	68
Peterson [151]	1920		47		14
Schweitzer [152]	1921		177	63	12
Davis [153]	1922	46	20	43.5	3
Gaydoul and Schmitt [154]	1922		50		10
Giesecke [155]	1922	350	224	64	44
Franz [156]	1925		285	77.1	46
Bonney [157]	1925	303	192	63.3	32
Weibel [158]	1925		1000	48	160
Philipp and Gornick (Bumm) [159]	1927	1011	201	38.2	30
Wille (Franz) [160]	1927		296		42

3239 cases with 40.5 per cent of five-year cures

cases that are good risks, reserving for radium all the early cases that are bad operative risks. Since the resistance of the patient is such a great factor in aiding a cure, the objection appears valid. Yet if we restrict our radium series to the clinics which for many years have treated all their cases with radium alone, employing no surgery whatever, the figures are essentially unchanged. Kehrer, Baisch, Doederlein, Clark, Bailey and Healy, Ward and Farrar, and Schmitz are examples of this group that give results with radium for the operable group alone. Their combined cases total 2057; 303, or 14.7 per cent of which were operable but were treated with radium with 125 cures, or 41.2 per cent. These results do not compare at all favorably with

FOR OPERATIVE DEATHS, CASES LOST FROM FOLLOW-UP OR DEAD OF INTERCURRENT DISEASE

Cases Lost from Follow-up	Death from Intercurrent Disease	Death from Cancer	Cured After Five Years	Per cent of Five-Year Cures	Remarks
0	0	0	7	54	Cures 7 to 12 years
0	0	13	10	31.3	
	1		54	32.3	
	25		77	49	
0	0	10	20	57.1	
3			107	31.5	
	3	12	18	42.6	Operability of all cases up to time of his report is 15.7 per cent. This includes cases much more recent than his five-year study.
0	2	73	90	50.9	
		9	8	40	
2	1	22	15	30	Total series 213 cases; 126 operated by various methods. Operability 59 per cent, only 50 were Wertheim's. In 1910-1912, 89 cases applied for treatment, of these 67 were operated. Operability of 74 per cent.
7	7	93	75	33.5	
5		135	114	40	Includes series 1904-1907; 1910-1912; 1915-1917. Cases 1913-1915 are omitted because 22 of the 98 operated cases were lost from follow-up
7	5	70	78	40.6	
			425	42.5	
			82	40.8	805 cases were radiated; 206 operated, 5 of them after radium. These are not included. Series 1913-1919 includes one year of cases reported by Bumm in 1919
			133	44.9	

and 534 operative deaths or 16.5 per cent

those of Wertheim and Weibel, von Franqué and Faure, who alone of the surgeons give their results with truly operable cases alone (page 366). Kehrer, Doederlein, Menge, Regaud, Schmitz and Heyman, who use radium and not surgery, report a total of 2284 cervical cancers of which 735, or 32.2 per cent, were operable or border-line, of which 263, or 35.8 per cent, are five-year cures. Deducting Schmitz's cases, since he excludes 57 from his compilation, and those of Regaud, since 14 of these died of intercurrent disease and reduce the percentage of his cures, we have 1900 cases with 623, or 32.8 per cent, of operable and border-line cases treated with radium, and 37.4 per cent of cures.

The above convinces the authors that the forensic question as to how best to treat the early cases is by no means settled, and that radium has not yet proved of greater value than surgery, provided the surgeon is expert and turns back the ureters so that he may remove in one piece the tubes, ovaries, uterus, parametrium, and half the vagina according to the method of Wertheim, Bumm, Ries, or Franz. This is a truly formidable operation which can be properly employed only in women who are good operative risks, a group who form unfortunately a pitiably small per cent of cases applying for relief.

FIVE-YEAR CURES AFTER RADIUM. OPERABLE CASES ONLY. NO DEDUCTIONS FOR CASES LOST FROM FOLLOW-UP OR DEAD OF INTERCURRENT DISEASE BEFORE FIVE YEARS

Reported By	Year	Total of Cases Treated	Number of Operable Group I	Per Cent of Group I	Number of Group I Radiated	Five-Year Cures	Per Cent of Five-Year Cures
Schäfer (Bumm)	1920	282	74	26.2	74	25	33.8
Burnam	1920	213	14	6.6	4	2	50
Seitz	1922	58	8	13.8	8	4	50
Kehrer	1922	129	19	14.7	19	11	58
Beuttner	1923	63	9	14.3	9	4	44.4
Clark and Block	1924	144	22	15.3	22	6	27.3
Schulte (Baisch)	1924	191	62	32.4	62	18	29
Bailey and Healy	1924	266	25	9.8	25	9	36
Franz	1925	105	43	41.0	43	13	30.2
Ward and Farrar	1925	76	18	23.7	18	9	50
Scholten and Voltz (Doederlein)	1925	1068	147	13.9	147	64	43.5
Schmitz	1926	183	10	5.5	10	8	80
Ransohoff	1926	60	7	11.7	7	4	57
Lynch	1926	107	19	18.0	5	1	20
Keene (Clark)	1926	214	13	6.0	13	7	53.8
Philipp and Gornick (Bumm)	1926	805	180	22.4	180	51	28.3
		3964	670		646	236	36.5

Nor is there justification for even this operation unless the surgeon has been trained to do it, and the case has had preoperative radium.

We are convinced that until the question is fully settled the average surgeon the world over will cure more cases with infinitely less risk if he operates no cervical cancers but treats them with radium alone, in the meantime awaiting newer developments in this field.

METHODS OF RADIATION.—Heyman,[131] in 1924, described his method as follows:

For gynecological purposes we employ "Dominici tubes" only. All the tubes contain radium sulphate. The tube walls are made of gold only, of gold and silver, or of platinum and silver. The thickness of the metal is chosen so as to be equivalent to 1 mm. of lead. Our tubes for vaginal application have been manufactured at different times, and vary somewhat as to length and thickness. The tubes of the same period are therefore usually employed in groups, as shown by the classification on page 398.

FIVE-YEAR RESULTS WITH RADIUM IN OPERABLE AND BORDER-LINE CANCERS OF THE CERVIX

Reported By	Year	Total Number of Cases Treated	Number of Groups I and II	Per Cent of Groups I and II	Number of Groups I and II radiated	Radiated Five-Year Cures	Per Cent of Five-Year Cures	Remarks
Schweitzer (Zweifel)	1921	102	61	60	8	2	25	Divided his cases into operable and inoperable only
Kehrer	1922	129	59	46.2	59	24	40.7	
Schulte	1924	191	91	47.6	91	24	26.4	
Scholten and Voltz (Doederlein)	1925	1068	357	33.4	357	110	30.8	
Schmitz	1926	183	31	17	31	15	48.4	
Ransohoff	1926	60	20	33.3	20	5	25	
Eymer (Menge)	1926	203	63	31	63	35	55.6	
Regaud	1926	201	81	40.8	81	15	18.5	Fourteen patients died of intercurrent disease before five years observation
Heyman	1927	500	144	28.8	144	64	44.4	
Philipp and Gornick (Bumm)	1926	805	406	50.4	406	100	24.6	
					1260	394	31.3	

For vaginal application:

Group 1. Fourteen tubes, each containing 5.1 mgm. el. on an average, totaling 71.98 mgm. el. Length 22-29 mm., outer diameter 2.5-3.2 mm.

Group 2. Ten tubes, each of 7.1 mgm. el., totaling 70.96 mgm. el. Length 19 mm., outer diameter 3.5 mm.

Group 3. Ten tubes, each of 4.7 mgm. el. totaling 47.09 mgm. el. Length 20 mm., outer diameter 2.8 mm.

Group. 4. Eight tubes, each of 9.35 mgm. el. totaling 74.77 mgm. el. Length 11 mm., outer diameter 2.8 mm.

For intrauterine application:

No. 5. One tube containing 40.1 mgm. el. Length 22 mm., outer diameter 3 mm.

No. 6. One tube, containing 33.7 mgm. el. Length 33.5 mm., outer diameter 3.6 mm.

No. 7. Two tubes, each containing 23.0 mgm. el. Length 15 mm., outer diameter 2.8 mm.

No. 8. Two tubes, each containing 23.0 mgm. el. Length 25 mm., outer diameter 2.8 mm.

These tubes, when in use, are packed in cylindrical or flat applicators made of lead with a thin casing of silver (0.3 mm.). The wall of the applicator has a total thickness of 2 mm.; the wall of the tubes having a thickness of 1 mm., the total filter will be equivalent to 3 mm. of lead. (Some older applicators have a wall thickness of 3 mm., and are provided with a brass casing.)

The applicators intended for intrauterine use are cylindrical. Wrapped with rubber these applicators are introduced sterile into the uterus.

For vaginal application we generally employ cylindrical or flat applicators. The cylindrical applicators are used two and two together. Of the flat applicators usually one is employed, seldom more. We have flat containers of various shapes and of several different sizes. These cylindrical and flat applicators are screened secondarily with two sheets of paper, a thin layer of cotton wool and oiled silk. Each cylindrical applicator holds half the number of tubes belonging to Groups 1, 2, 3 and 4. The flat applicators hold all or some of the tubes belonging to these groups.

The choice of cylindrical or flat applicators depends upon the appearance of the tumor surface. Cylindrical applicators are most suitable when the tumor is crater-shaped. Flat applicators are most convenient in disk-shaped tumors. Large cauliflower growths sometimes demand special arrangements, several applicators or radium packs of sheet-lead prepared for the particular case. We endeavor to cover as accurately as possible the whole of the vaginal surface of the tumor with radium.

He describes his treatment as follows: In a case of carcinoma of the cervix:

Three treatments are given, the second, one week after the first; and the third, three weeks after the second. At each treatment the same amount of radium is used and for the same length of time, as follows:

Quantity of radium: in the uterus, 33.7 or 40.1 mgm. el.; in the vagina, about 70 mgm. el. Time of treatment, 22 hours, equivalent to 741-882 mgm. el. hours

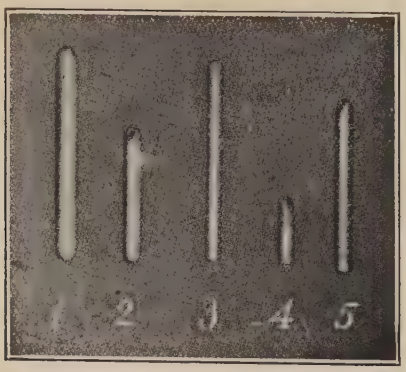
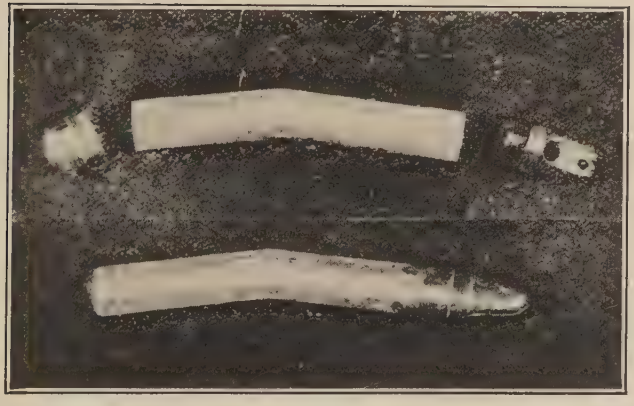


FIG. 4.—RADIUM TUBES OF VARIOUS TYPES, CONTAINING 33.7, 40.1, 4.7, 9.37, AND 16 MG. EL.

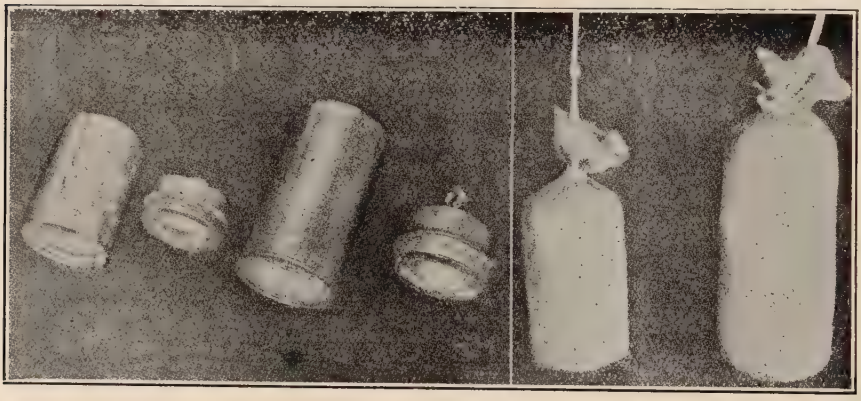
Full size. The property of Radiumhemmet. (Heyman, *J. Obst. & Gynæc. Brit. Emp.*, Jan., 1924.)



FIGS. 5 AND 6.—CYLINDRICAL APPLICATORS FOR INTRA-UTERINE APPLICATION, FIGS. 5 AND 6-B WITH LIDS UNSCREWED.

Full size. The property of Radiumhemmet. (Heyman, *J. Obst. & Gynæc. Brit. Emp.*, Jan., 1924.)

FIG. 7.—THE CYLINDRICAL APPLICATOR OF FIG 5, READY TO BE INTRODUCED INTO UTERUS (Heyman, *J. Obst. & Gynæc. Brit. Emp.*, Jan., 1924.)



FIGS. 8 AND 9.—CYLINDRICAL APPLICATORS MADE TO CONTAIN FIVE AND SEVEN RADIUM TUBES, AND INTENDED FOR VAGINAL APPLICATION.

With lids unscrewed (Fig. 8), and ready to be introduced into vagina (Fig. 9). Full size. The property of Radiumhemmet. (Heyman, *J. Obst. & Gynæc. Brit. Emp.*, Jan., 1924.)

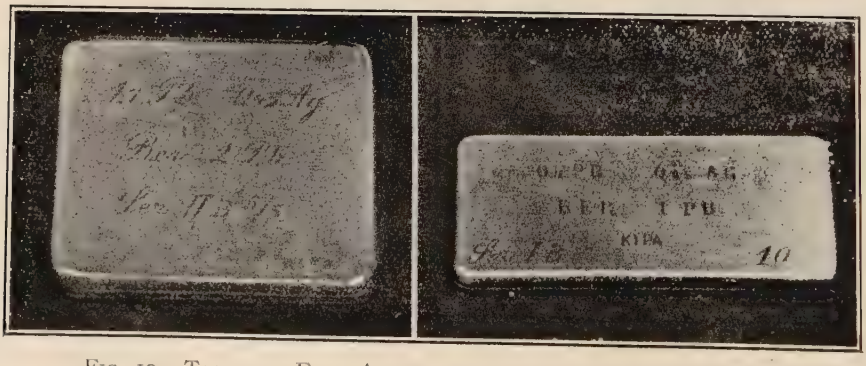


FIG. 10.—TYPES OF FLAT APPLICATORS FOR VAGINAL APPLICATION

Full size. The property of Radiumhemmet. (Heyman, *J. Obst. & Gynæc. Brit. Emp.*, Jan., 1924.)

in the uterus; and 1500 mgm. el. hours in the vagina. Filter, equivalent to 3 mm. of lead.

The total treatment which the patient receives is thus about 2220-2640 mgm. el. hours in the uterus, and about 4500 mgm. el. hours in the vagina.

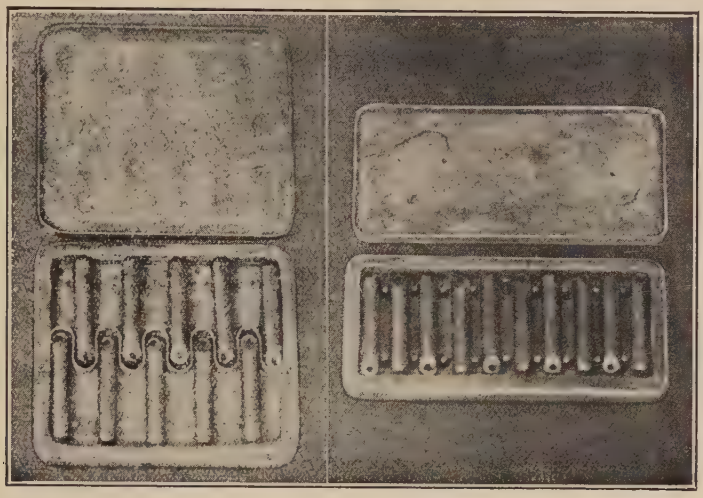


Fig. 11.—The Same Applicators with Their Tubes

(Heyman, *J. Obst. & Gynæc. Brit. Emp.*, Jan., 1924.)

This typical treatment is, however, varied according to circumstances. If by the clinical examination there is reason to suppose that the body of the uterus is involved, or if the uterine cavity is exceptionally long, we apply from 46 to 73.8 mgm. el. in the uterus, without so far having considered it necessary to reduce the time of application. Judging from our own experience, it is possible to increase the

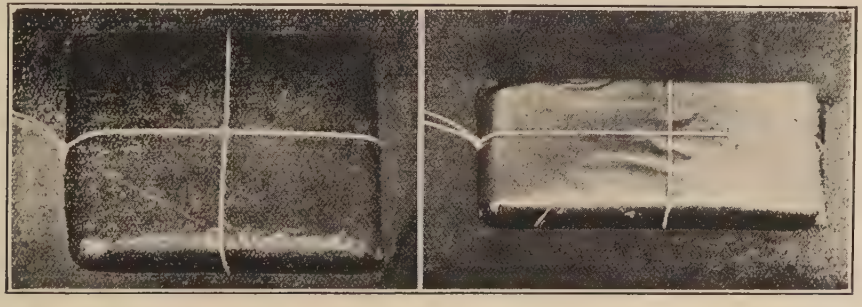


Fig. 12.—The Same Applicators Ready to be Introduced into the Vagina

(Heyman, *J. Obst. & Gynæc. Brit. Emp.*, Jan., 1924.)

quantity of radium in the uterus without any risk of injury to the surrounding tissue. If the uterus is small or atrophic we sometimes insert only 23 mgm. el. If the vaginal surface of the tumor is large the quantity of radium applied in the vagina may be increased at the first treatment, though to not more than 140 mgm. el. at the most. By reducing the time of application or the quantity of radium in the

second and third treatments we manage to prevent the total vaginal dose from exceeding 4500 mgm. el. hours. When treating old or very weak patients we often employ smaller doses, sometimes also when the tumor is small. In the cases considered in this report three treatments have been usually given.

The greatly increased number of patients in the last five years has made it necessary for us to concentrate the treatment in a considerable number of cases. At first we proceeded very tentatively and cautiously; for the last three years, however, we have given with increasing frequency only two treatments at an interval of three weeks, the duration of the first treatment being about 32, and that of the second about 24 hours. In a more concentrated treatment the dose must be reduced. Judging from our experience 4500 mgm. el. divided into three treatments seem to equal 4000 mgm. el. at the most given in two treatments. Our results with two treatments instead of three lead us to think that this may be a very good method. However, we advise great caution until this method has been further tested. We have also made experiments with one single treatment, but this method has been tried for too short a time for us to give any useful opinion thereon.

Method of Treatment. Prior to the application of the radium the patient is given a purgative. Narcosis is necessary only in exceptional cases (virgins, or in married women with rigid soft-parts), but each patient is given 1 cgm. of morphine before the growth is examined and a portion of it removed for microscopic examination. Coincident with the examination, the various data are entered in the patient's paper, and the radium tubes are packed into the cylindrical or flat applicators that are most suitable for the case in question. The vagina and the tumor surface are then cleansed extremely carefully with benzin (which, in our opinion is better than hydrogen peroxide, tincture of iodin or alcohol), and the sound is passed into the cervical canal. A practiced hand can, as a rule, manage to pass the sound, though sometimes only after a somewhat prolonged trial. It is rather remarkable how often one finds the entrance to the cervical canal in the periphery of the tumor, so that the radium applicator may be introduced straight into the uterus, and apparently without having to come into contact with the breaking down tumor.

To be able to introduce our applicators into the uterus we have to dilate with Hegar dilators up to and including No. 8, and this very seldom with difficulty. Not until the intrauterine applicator has been introduced is biopsy performed. Otherwise one is apt to be impeded by a troublesome hemorrhage. As a rule we take tissue for study even if a microscopic examination has been made beforehand. Apart from this we advise absolutely against all such procedures such as cauterization and excochleation. They do not aid in treatment, and are attended with a risk of infection and of dissemination of the growth.

Lastly, the vaginal radium packs are fitted in and plugged with gauze as firmly as possible in the desired position. This tamponing is done in a particularly careful manner between the radium applicators and the posterior wall of the vagina to diminish the risk of injuring the sensitive rectal mucous membrane by increasing the distance between the source of the rays and the rectum. An exact application of the radium, based on a careful examination, and a minute observation that the radium is lying firmly fixed against the surface of the tumor is, in our opinion, one of the essential points in all radium treatment.

At the next treatment or treatments one proceeds in a manner similar to the one employed on the first occasion. The radium packs to be applied in the vagina are suited to the changed appearance of the tumor. The biopsy is not repeated. We

believe that our worse results in 1916 were partly due to the fact that tissue for study was taken repeatedly.

No further treatment is then given as long as the tumor shows a tendency to heal. It is useless to treat further such tumors that do not show a steadily progressing improvement in the first six months. Our attempts in 1913-1915 to secure a good result by extending the treatment showed us that a repetition of the treatment within the first six months is only doing harm.

If a tumor begins to grow again during the second six months or later, a fresh, careful treatment may be tried, though preferably not until about a year after the first one, and then only one application is made with a small dose. In this way one may obtain a further improvement for a short time, and in exceptional cases one may eventually keep the patient in good health even for quite a long time.

As a rule, a tumor which has been steadily improving for a year following the treatment, is clinically healed. Fairly often, however, one may find small persistent thickenings of the tissue in or close by the vaginal portion of the neck of the uterus or in the parametria. One does not know whether such thickenings are due to cancer or to some "reactive" inflammation associated with the treatment. In the last-mentioned cases, as well as in those clinically healed, we do not again treat the patient until the clinical aspect proves with certainty that there is a "recurrence." On a mere suspicion, so to speak, we do not apply radium, for we have had, in the course of years, a number of cases in which we have had reason to suspect that the tumor had begun to grow again, but in which the suspected "recurrence" healed without further treatment. On the other hand, we have observed a number of similar cases in which there has been such a rapid change for the worse after the repeated treatment, that one has come to the conclusion that this change has been due to or has been hurried on by the treatment.

We have abandoned the combined radium-Roentgen treatment, since we have found that the results were not much better, but rather worse than with radium treatment alone. Nowadays we resort to Roentgen treatment in conjunction with the first series of radium treatments in those cases only in which there are extensive glandular metastases from the very start, for experience has taught us that radium treatment alone does not lead to the desired result in these cases. In some few cases we have seen a temporary and very considerable reduction in the size of metastases after Roentgen treatment, though this has almost without exception been of short duration. Severe pains, persisting in spite of the radium treatment, may sometimes be favorably influenced by Roentgen treatment.

In our Roentgen treatment we do not employ the massive doses. On each field we make two or three exposures, each of one-half or one-third of an erythema skin dose, one exposure a day or every second day. The exposure is generally distributed on two anterior fields and one backfield. Filtration through 0.5 mm. of copper. A spark-gap of 38 cm. between the point and the disk. Skin-focus distance from 23 to 30 cm.

Schmitz' [132] technic is described by him, in 1926, as follows:

The roentgen rays are applied with the following factors: Kilovoltage 200; milliamperes 25; filter 1.0 mm. copper plus 1.0 mm. aluminum; size of fields 15 cm. by 20 cm.; focus skin distance 50 cm.; time duration of application to each field 25 minutes—that is, 625 milliampere minutes, or about 10½ milliampere hours.

The kilovoltage, milliamperes and filters are constant factors; the focus skin distance is only exceptionally changed when treating very large or obese women; the size of the fields and the time duration of applications or milliampere minutes are variable factors. However, we endeavor to maintain all the factors as constant as possible to avoid errors in the application of the X-rays.

The upper border of each field corresponds with the height of the sacral promontory and the lower border includes the level of the perineum. Thus the entire true bony pelvis and the external genitalia are included in the radiation fields. A cervical carcinoma involving the lumbar lymphnodes is considered so advanced as to be hopeless from the standpoint of any therapy. We, therefore, never extend the radiation fields above the promontorium sacri.

The depth dose at 10 cm. of X-rays obtained with the factors cited is, with a focus skin distance of 50 cm. 42 per cent; and with a focus skin distance of 65 cm. 49 per cent of the surface intensity. The 100 per cent erythema skin dose is obtained with a 50 cm. E.S.D. in 625 milliampere minutes and with a 65 cm. E.S.D. in 1050 milliampere minutes. Our 100 per cent E.S.D. equals about 2300 e. of Friedrich's electrostatic unit, or about 1000 R. The 2300 e. represent the electrostatic units of Friedrich as corrected by Bachem and are 230 e. of Friedrich's original units.

The number of fields is either three or four. The three fields are placed over the symphysis and right and left buttocks; the four fields are placed over the symphysis, the sacrum and right and left hip regions. The time duration of application to each field is calculated as follows: A transverse diameter of the pelvis at the level of the cervix is made on transparent paper or linen. The equal intensity charts of Bachem, or Fricke and Glasser are used in calculating the X-ray intensities. They differ somewhat from Dessauer's equal intensity charts, due to the fact that we surround the radiation field with rubber and lead sheeting at the level of the skin. The time duration is calculated so that the skin does not receive at any place more than 120 per cent E.S.D. though we attempt to maintain a 100 per cent E.S.D. if possible. The 120 per cent E.S.D. is the highest permissible dose and causes a severe reaction with a loss of the upper layers of the skin. The injury to the skin heals without difficulty. Latent changes are rarely seen and consist of telangiectasia and indurations. We never repeat the treatment as the skin will not stand another application of X-rays even if the dose is markedly reduced.

We found that the combined surface intensities usually indicate the attained percentage intensity of the radiation throughout the true pelvis which is usually about 15 to 20 per cent less than the surface intensities. Therefore, if we wish to attain a 100 per cent E.S.D. throughout the true pelvis, we must raise the skin dose to 120 per cent E.S.D.

Since the highest permissible skin dose of X-rays does not enable one to apply a dose which would degenerate the greater number of cervical carcinomata, radium rays are added to the X-ray dose. The radium capsules contain 25 mgm. of element enclosed in a silver capsule of a wall thickness of 0.5 mm. Two such capsules are placed in a brass filter of 1.0 mm. wall thickness. The equal intensity curves were determined in Friedrich's Institute by Huth and the writer. The equal intensity curve 20 is 3 cm. distant from the longitudinal axis of the radium capsule. It is the most important of the isodoses as it runs through the posterior bladder wall and the anterior rectal wall. The tissues between these two structures may receive any amount of radiation, but at the vesical and rectal mucosae the

combined X-ray and radium intensity, should never be more than 180 per cent E.S.D. The 100 per cent E.S.D. at isodose 20 is obtained with 4800 mg. el. hours or a time duration of 96 hours. Entering the equal intensity curves on the transverse diameter we may calculate any amount of dose of combined radium and X-rays. Our combined X-ray and radium method is therefore a modification of that used by Opitz and Friedrich.

A course of treatment is arranged as follows: A radium application of 48 hours is made first. Strictest asepsis is observed. The patient is invariably anaesthetized, nitrous oxide or ethylene gas being used. Careful bimanual vaginal and rectal, and cystoscopic examinations are made to determine the extent of the cancer. An excision of tissue is done for diagnostic and therapeutic purposes. The cervical canal is carefully dilated and the capsule placed in it. The vagina is firmly packed to displace the posterior bladder wall forward and the anterior rectal wall backward as far as possible. A retention catheter is inserted into the bladder. On the third to sixth days the X-ray treatments are given, one field a day; and on the seventh day the radium capsule is again inserted from 24 to 48 hours depending on the microscopical report and the dose desired.

The treatment is almost invariably followed by vesical and rectal irritation. However, they are only temporary and usually abate within ten to fourteen days. The patient, therefore, remains in the hospital usually three to four weeks. Exceptions, of course, are made. Either the patient's condition is weakened so, that the dose must be divided, when only one-third of the treatment is given; the second one-third follows during the fourth week and the third treatment during the eighth week. Or at other times the patient may develop a pyrexia, or vomiting and diarrhea may become very severe compelling us to interrupt the treatment temporarily. As soon as these complications have subsided the treatment is resumed and finished.

To forestall the skin reaction the patient is advised to apply Dodd's lotion to the skin of the hips, buttocks and nates. Vaginal douches of solutions of white pine extract, and rectal retention enemas of oil are made mornings and evenings. Severe tenesmus requires rest in bed. The diet is bland and consists chiefly of milk, strained gruels, baked or mashed potatoes, toast and butter. Vomiting indicates large doses of calcium lactate, sodium bicarbonate or dilute hydrochloric acid. Acidosis requires the former, alkalinosis the latter. Vesical tenesmus is relieved by the internal administration of belladonna and sodium bromid. Suppositories containing 0.06 gm. of pulverized extract of opium must be given in severe cases to relieve rectal and vesical pain. Should leukopenia occur and persist, then transfusions of whole blood are made.

Blood and Urine Changes after Radium Treatment.—Matthews and Mazzola,[160] in 1928, made blood and urine studies on 100 gynecologic cases treated with radium with the object of determining the possible relationship existing between "radium sickness" and alterations in the blood. The examination included the nitrogen partition, carbon dioxid combining power of the plasma and blood sugar reading before and after treatment. Benign and malignant lesions were included in the group. A mild reaction occurred in 40 per cent of their cases which could be attributed either to preoperative medication or the anesthetic or both. The blood urea was slightly elevated after radiation but no definite relationship could be established between this

increase and the reaction. The carbon dioxid reading was not altered by irradiation nor was there any evidence of kidney impairment.

Lenz,[133] in 1927, described the technic of radium application now used at the Radium Institute in Paris. They do not use Roentgen ray as accessory treatment given in fractional erythemal doses to the thymus, spleen or lymph-nodes as suggested by Frankel with the hope of increasing the resistance of the body to cancer. They feel that these organs are undergoing the normal process of age involution in the majority of their cancer patients when they first come for treatment. Nor do they attempt to increase the resistance of the body to cancer by foregin proteins or vaccines or by diathermy or galvanic currents. The treatment is practically limited to local radium therapy. When radium and x-rays are combined, the x-ray precedes the radium.

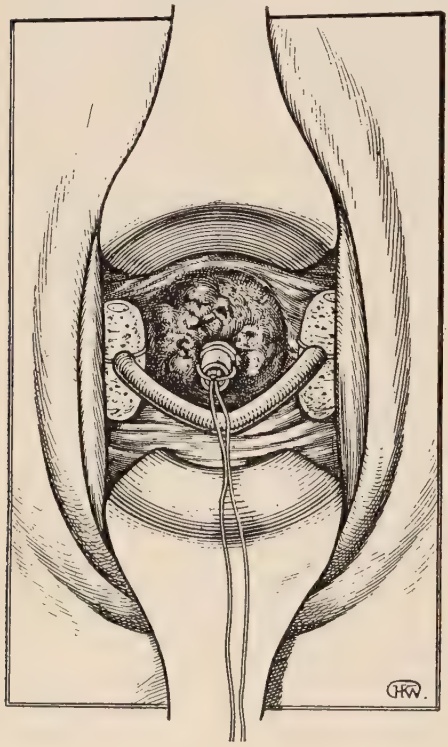


FIG. 13.—CERVIX VIEWED FROM THE VAGINA.

End of uterine applicator slightly protruding from the cervix. Corks of the colpostat in each lateral fornix.

Three radium capsules, approximately 20 Mm. long and screened with glass, and 2 Mm. of platinum are introduced into the uterus according to Regaud's method. The upper capsule within the fundus usually contains 6.66 mc. of radium element. Each of the lower tubes contains 13.33 Mm. When radon is used, the initial quantity is 15 to 20 mc. per tube. Vaginal applicators consist of similar radium-bearing capsules containing 2 Mm. platinum wall, each capsule being inserted through the center of an ordinary cork, 1.5 cm. broad to 2.5 cm. long, thus leaving more than 0.5 cm. of cork on either side for focal distance. After the radium capsule with the aluminum wrapping has been inserted into the cork, the open ends are closed by plugs of cork and the cork mass is tied all along its long axis by a silk ligature. It is then immersed in boiling paraffin at 120° C. for twenty minutes. This sterilizes the applicator and covers it with an impermeable layer. Two of these corks are mounted on a 10 × 1 cm. steel strip that is covered by rubber tubing and are placed in the vagina so that one capsule lies in each lower side of the lateral fornix, the ends directed toward the bladder and rectum. The spring action of the steel strip forces the corks against the vaginal wall and maintains them in a vertical position in the vagina, in close proximity to the parametrium, while the bladder and rectum receive the radiation only from the ends of the capsules. About 26.66 Mg. of radium elements is usually employed in the

vaginal application. It is left in place for five days, thus giving together with the uterine applicators a total dose of 7000 to 8000 Mg.-hours. The treatment is never repeated unless recurrence develops. The applicators are removed once each day and cleansed; the uterine applicator is boiled and a vaginal douche of hot water is given and the applicators are again inserted. If fever and chills occur during the treatment the uterine applicator is removed so as to allow free drainage while the vaginal radiation merely is continued. If the temperature does not become normal within twenty-four hours all the radiation is discontinued until signs of infection have passed.

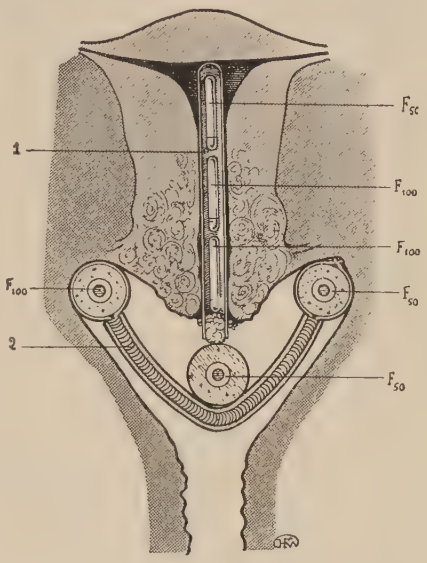


FIG. 14.—CROSS SECTION OF UTERUS AND VAGINA WITH RADIUM APPLICATORS IN POSITION.

1. Uterine applicator consisting of three tubes, the upper focus (F) delivering 50 microcuries, the lower two each 100 "microcuries destroyed" per hour. 2. Cross section of three vaginal "corks" with vaginal radiating foci (F), one delivering 100, the other two each 50 "microcuries destroyed" per hour. Two of the corks are mounted on the colpostat while one is lying free.

Personally we feel that more cures will be effected by radium which is inserted into the cervix and is accompanied with a cross-fire from the upper vagina than from radiation of the cervical canal alone. Nor does it seem logical to limit the radium treatment to a pack inserted in the upper vagina unless one uses a tremendous amount of radium, large enough to thoroughly ray the entire pelvis. We also believe that better results can be obtained from a large amount of radium applied for a comparatively short period of time than from a smaller amount given sufficiently long to total the same number of mc-hours, since there are more long rays in the larger amount of radium. We have used for some time a mushroom type container, the stem of which is inserted into the cervix while the button contains four radium tubes placed in a quadrangle so that it will thoroughly ray the pelvis. This method is rather akin to that of Heyman, whose detailed method has been previously described. Several students who place their reliance upon a radium capsule which is inserted in the cervix obtain cross-fire from radium needles which are inserted in the edge of the parametrium. Some object to this method on the ground that it is apt to injure the ureters. This is not a valid opinion since hydro-ureter is present in every late case of cancer and results from the compression of the ureter by the tumor. Personally we feel that one can obtain better results by inserting the radium in a hole burned in the center of the tumor than in the cervix unless that cavity is surrounded by the tumor. Nor do we believe that it is good treatment to forcibly dilate the cervical canal prior to inserting the radium, since there is every reason to believe that the

cancer may be excited to greater activity by such trauma. A hole in which the radium may be inserted may be made by a Paquelin cautery or more readily by a high frequency knife of the type that has recently come into such widespread use. The literature shows no agreement as to the dosage of radium. Various amounts are urged ranging from 2500 mc. or Mg.-hours to as much as 8000 mc.-hours. It is an interesting commentary that about the same per cent of cases are reported as cures with each of these two extremes. There may be doubt, however, as to the permanency of the cure with the smaller amounts; possibly much depends on how it is given, whether by an application in the cervical canal alone or by cross-fire through the vagina. Nor is there agreement as to the proper amount of screening, although there is little doubt that those who use the larger doses should use the heaviest screen. The usual screening corresponds to 2 Mm. of silver or lead, exclusive of the glass capsule for the alpha rays, and of a rubber, silk or cotton cover of the capsule. Heyman, who advocates doses of 6700 to 7100 Mg. el-hours, screens with what corresponds to 3 Mm. of lead in addition to the accessory screening just mentioned. There is no doubt that the physician who uses extremely large doses of radium in the cervix may do much harm unless the capsule is heavily screened. Five and a half years ago we gave to one of our cases 4000 mc.-hours at one sitting from radium capsules totaling 204 mc. which were held in the cervical canal for twenty hours. There was no cross-fire from the vagina. The tumor presented as a polyp, the size of a fifty-cent piece, springing from the posterior lip of an enlarged and infiltrated cervix which presented no ulceration. The radium container was 2 inches long and held three radium tubes of approximately 68 mc. each. The screening was 0.5 Mm. silver, 1.2 Mm. brass and 2 Mm. of rubber. The patient passed mucus and blood from the bowel a few weeks later. We elected her for a Wertheim operation several months after the radium treatment, at which time we found a partial intestinal obstruction and a burn 1.5 cm. in size upon each of two loops of the ileum which were firmly adherent to the uterus. While the case remains as a five-year cure, and is now perfectly well, she developed a fecal fistula after the operation, which necessitated a secondary closure. It convinces us that the dose was excessive and should not be regarded as good treatment. At present we are limiting cervical application to 2500 mc.-hours, varying in amount depending upon the amount of cross radiation from the bomb of the vaginal capsule.

Nearly all the older authors advise against removal of polypoid masses when the growth presents as an everting tumor. Even Heyman does not touch them but prepares special radium capsules to treat this rare form of growth. The treatment has never seemed reasonable in our eyes since it must be apparent that we should endeavor to ray advancing edges of the tumor rather than the free margins that present in the vagina. As we have stated in the monograph, everting tumors should be most favorable from the standpoint of cure because such cancers expend more of their energy in growing in the plane of least resistance—the vagina—than in extension into the surrounding tissues. The report of Keene is of great interest in this connection

and once more recalls the excellent cautery work of Byrne—now many years ago. Keene reported, in 1926, 6 cases that were treated by high cautery amputation of the cervix immediately preliminary to radium, with 5, or 83 per cent, of five-year cures. While this is too small a series upon which to base definite conclusions, as Keene states, it adds weight to other observations that the combination of radium and cautery treatment when the vagina is partially filled by a cancerous polyp will be followed by better results than from radium alone. Radiation from small gold seeds—an improvement upon the glass implants described in the last supplemental review—is of use in treating only small and local metastases.

Anesthesia for Introduction of Radium.—The question of anesthesia is worthy of discussion since there is no doubt that a long anesthesia given to facilitate the introduction of radium into the cervical canal or the tumor tends to reduce the vitality of the patient. Anesthesia may be necessary but should not be given if it can be avoided. Caudal anesthesia usually suffices, but if inhalation anesthetic is demanded, ethylene and oxygen or nitrous oxid and oxygen are far preferable to ether.

We have been greatly impressed with the fact that anything which depresses the vitality of the patient militates against her cure. In a review of our cases we have found as many five-year cures when our radium treatment was limited to vaginal applications which required no anesthesia, as when we used radium applied directly into the cervical canal after its dilatation when the patient was under ether anesthesia. We are unable to interpret these results except on the ground that dilatation of the cervix activated the growth and the ether anesthesia added to the reduction of the patient's resistance.

Postradiation Care.—Largely because of the observation just cited, we have come to believe that one of the greatest advances in the treatment of the cancer patient in recent time is the routine blood transfusion so strongly urged by George Gray Ward, Jr. Those who routinely make blood studies in cancer patients who have cervical ulcers (which are invariably infected) must be impressed with the fact that low blood-counts are uniform findings. Blood transfusions greatly improve the condition of such patients. Ward, however, as a routine, gives transfusions to all cases and does not limit the procedure to women with frank anemias, a method so reasonable that it requires no comment. Unfortunately this method has not had as wide an adoption as it deserves, in spite of the fact that nearly all authors agree that any detail which may increase the resistance of the patient is worthy of careful consideration.

There is no doubt but that the patient's condition may be improved by proper diet. A diet rich in eggs and milk has long been urged. More recently we have learned the value of the liver diet for blood regeneration, a discovery made by Whipple which was subsequently taken up and popularized by Minot. The liver diet has accomplished marvels in blood-building. Its value has been definitely proved. We cannot urge too strongly the observance of every detail to develop the resistance of the patient, blood transfusions, diet and general hygiene.

Four years ago we started sun baths as a routine on all our cancer patients. We are of the belief that it has been of great value in increasing the patient's strength. While it is never possible to give credit for cure to any one agent when we have used radium, Roentgen ray, blood transfusions, liver diet, sun baths and a careful hygiene, we recall distinctly cases in whom the cancer did not appear to be controlled until the sun baths had been taken. Once more we urge that, in the treatment of a disease as fatal as is cancer, the careful physician will overlook no detail which contributes toward building up his patient's reserve.

Deep Roentgen-Ray Treatment.—The literature offers no basis for estimating the extent to which the deep Roentgen ray participates in the cure of cancer, because there were comparatively few modern Roentgen-ray machines prior to 1921 (after which we cannot now study five-year cures). Many American students are enthusiastic over the possibilities of the deep Roentgen-ray treatment given as an adjunct to radium. The hard Roentgen ray plays a large rôle in Schmitz' routine treatment. Healey, at the Memorial Institute, urges, as do many others, its use as a routine. Deep Roentgen-ray treatment has been developed largely in Germany, possibly because comparatively few clinics have large amounts of radium. Proof of this is shown by Fürst, who listed in 1926 the radium equipment of thirty-six German and Swiss universities. Of this number there were only three that in 1926 had more than 200 Mg. of radium: Berne having 300, Zurich 254 and Berlin but 216.

Some Germans have reported results from deep Roentgen ray alone which compare favorably with those obtained by radium alone or in combination with deep Roentgen ray. Zweifel, [134] in 1923, cites the following: The Munich clinic using radium alone or in combination with deep Roentgen ray treated, between 1913 and 1921, 1260 cervical cases with 180, or 14 per cent, of absolute cures; there were 199 cases of Group I (operable) with 78 cures (39 per cent). The Erlangen clinic used the deep Roentgen ray alone. Wintz [135] there treated 519 cervical cancers between 1915 and 1920 with absolute cures of 93, or 18 per cent; there were 67 cases of Group I (operable) with 38 five-year cures (57 per cent). Our review, however, indicates that Wintz in Erlangen included as five-year cures a number of cases which had been followed for only four years. Twelve cases of this series were followed for only four years, of which 9 remained as four-year cures. Similar good results have not been obtained in America from treatment with the deep Roentgen ray alone. Scholten and Voltz (Doederlein's clinic) report 147 operable cancers treated by radio-active substances only prior to 1918 with 43.4 per cent of cures; since 1918 they have supplemented the radium treatment with the Roentgen ray. Little difference, however, is shown in the percentages of cure since, prior to 1918 when they did not use the Roentgen ray, there were cured 48 of 110 operable cases, or 43.6 per cent, where in a smaller group beginning with 1918 which were treated also with Roentgen ray, there were cured 16 cases of 37 operables, or 43.2 per cent.

While this indicates the state of affairs prior to 1921, it does not necessarily mean that it holds true at the present time. There has been much recent

improvement in Roentgen-ray machines. The ray is harder and its penetration is deeper. Until the whole truth becomes known, it seems reasonable to use both radium and deep Roentgen ray because both agents have shown their usefulness as a therapeutic agent although neither one has cured more than a scant majority of even favorable cases. The time at which the Roentgen-ray treatment should be started is worth discussion since there is evidence that the rays give better results in comparatively well women than they do when the patient is run down, as they are likely to be after radium treatment. Until quite recently the Roentgen treatment was given after the patient had had radium. The French, however, are urging a reversal of this sequence, a proposal which has been recently adopted at the Memorial Hospital, and several other American cancer clinics.

Surgery for Inoperable Cases That Have Been Made Operable by Radium.—While there is not yet complete agreement concerning the advisability of this treatment, the majority of men who have tried it believe that the patient gains little by such operation. As a result of our own treatment of 8 such cases, we coincide with the view just stated. While one woman so treated remains well for nine years, we are not at all certain that radium alone would not have cured her. This case is cited in the monograph. Four others that we treated present as conspicuous failures since all succumbed to cancer within four years. A few authors advise a panhysterectomy, which to us is an illogical treatment since it removes only the tissues that have been sprayed by the radium. From the standpoint of pure theory, we should attempt to remove tissues situated farther away from the tumor. This is not practical since the Wertheim type operation cannot be carried out effectively at such a time; there is too much scarring from the radium. Moreover, the operation is difficult and carries both risk of life and the possibility of serious ureteral and bladder injury—to remove a comparatively small amount of parametrial tissue. The ureters in our cases have been so firmly imbedded in the parametrium that they could be freed only by knife dissection. All of the cases which we have treated have had hydro-ureter.

Radium Treatment of Recurrences Following Operation.—There is no doubt that most of these cases have had the wrong kind of operation with not a recurrence but a continuation of the disease. This holds true especially in panhysterectomy. Neither radium nor the deep Roentgen ray alone or in combination affords much hope for this type of case. Schmitz, in 1926, reports 4 per cent of five-year cures with radium and deep Roentgen ray in combination. Healey may possibly be more fortunate in his results. In February, 1927, he reports 29 such cases which were treated by him in 1922 at the Memorial Institute in New York City. Nine cases (31 per cent) were still alive at the time of his report four years later. The results are hopeful, although many of his cases cannot be considered from the standpoint of the five-year cure. Our own experience after a five-year follow-up is limited to 23 cases that were radiated subsequent to vaginal or abdominal hysterectomy by others, all of them competent surgeons. Seven of these women had no demonstrable cancer at the time of our first examination. Some of them still

had retention sutures in their incisions, having been brought to us less than two weeks after their operation. None of the 23 women had extensive areas of recurrence. All were radiated by a technic that had cured 9 per cent of absolutely inoperable cancers, yet none of the "recurrent cases" survived four years. There were 2 other patients who had had cervical resections for what were regarded at first as simple cervical erosions. The error was recognized by the laboratory sections a week later in one case, and by a rapidly growing cancerous area which appeared in the other shortly after operation. Both cases are five-year cures with radium. The detailed results are shown in the table on page 386.

Carcinoma of the Fundus.—There have been comparatively few reports of fundal cancers during the last two years. Charles G. Norris, [136] in 1926, reviews a series of 101 carcinomata of the fundus treated at the University of Pennsylvania, of which 24 were early, 53 were moderately advanced, and 24 were quite advanced. The clinical diagnosis was correct and positive in 57, doubtful in 24, and was in error in 20 which were considered benign until microscopic examination demonstrated malignancy. The necessity of early diagnosis is shown by the results. Fifty-six per cent of the cases who had symptoms for less than six months after operation were living for three years at the time of his report, as were 31.2 per cent who had had symptoms from seven to twelve months prior to operation, while there were only 17 per cent alive three years later who had had symptoms for a year or more before coming for surgical treatment. Twenty-six per cent of the cases occurred in spinsters. The 20 cases in which the clinical diagnosis was shown by the laboratory report to be an error and really carcinoma comprised 15 cases which were considered only fibroids, while 4 other cases were first regarded only as simple menorrhagias. Stewart and Young, in 1926, found that 40.5 per cent of their 38 fundal cancers were in nullipara.

Radium Treatment of Carcinoma of the Fundus.—Scholten and Voltz,[137] in 1925, reported from Doederlein's clinic 23 operable fundal cancers treated only by radio-active substances with 11 five-year cures, and 23 inoperable cancers of the uterine body with no cures. In the years 1918 and 1919, they treated 13 fundal carcinomata with radium supplemented with the deep x-ray. Five years later there were 7 survivors without evidence of recurrence. Heyman,[138] in 1927, relates their experience with the treatment of cancer of the uterus at the Radiumhemmet during the years 1913 to 1922. During this time, they treated 91 cases, 69 of which were treated with radium as a primary measure. Of the 69 cases treated primarily with radium, 42 per cent were inoperable, 36.2 per cent were technically operable and 21.7 per cent were operable. Five years later, 2 of the 5 clinically operable were alive and well as were 6 of the 8 of the technically operable, a total salvage of 13 operable cases, or 61.5 per cent. Of the inoperable cases, 44 per cent, or 4 of 9 cases, were without symptoms of cancer five years after their operation. Eymer [139] at Innsbruck reports in 1926 his results with the radium treatment of carcinoma of the uterine body for the years 1913-1919. He had 44 cases treated, with 9.1 per cent mortality. There were 9 five-year

cures in the 29 operable cases, or 31 per cent; 1 cure in 15 inoperable cases, 6.7 per cent.

Personally, we are of the belief that radium will come more and more into the treatment of fundal cancers, and that before very long there will be quite as much discussion concerning the value of surgery and radium in carcinoma of the fundus as ever has existed in cancer of the cervix. We are more and more impressed each year with the high mortality which we have had following hysterectomy for cancer of the fundus in our series, it being as high for an ordinary panhysterectomy in this group of cases as we have had for our radical operations for cancer of the cervix. The reason for this is clear. Women having cancer of the fundus are older on the average than those with cervical cancers. They are likely to be obese and have degenerations of the heart and kidneys, organs which normally become damaged with age. These cases withstand operation badly. Moreover, we have not had as many five-year cures after panhysterectomy for carcinoma of the uterine fundus as we have had after the radical operation for cancer of the cervix, a disease considered much more difficult to cure. From the standpoint of pure theory, a panhysterectomy for fundal cancer is not a reasonable procedure, because fundal cancers metastasize through the same channels as do cancers of the cervix. The surgical treatment of cancer in any part of the body must remain the same, that is, block excision in one piece, something that a panhysterectomy almost invariably fails to do. We are of the belief, therefore, that cases which are selected for surgery should be operated radically if they are good operative risks and have early growths, a contention that was long since made by Peterson. All other cases should be treated with radium. It may well be that before long this agent will supplant surgery for this type of cancer, just as it is now doing in carcinoma of the cervix.

VAGINAL CANCERS

Fortunately these growths are comparatively rare, since the literature shows that such cases are forlorn indeed. While there are many case records in the literature of survivors for two or three years, the usual result is well shown by Scholten and Voltz, who report 80 cases with one five-year survival, the fortunate individual being one of 15 who were treated with radium supplemented by deep Roentgen ray. Personally we have seen 2 cases within the last two years, neither of which survived for more than one year in spite of radium treatment supplemented by the deep Roentgen ray. Heyman's [140] results are somewhat more favorable. Between 1911 and 1922, there were treated 16 cases of primary cancer of the vagina in the Radiumhemmet in Stockholm; one lived three years, one four years and 2 five or more years. In both of the latter cases, the tumor was everting and was the size of a hen's egg before treatment.

LEAD TREATMENT OF CANCER

Since 1920, Blair Bell [141] has been treating cancer with colloidal lead and has obtained some interesting results, although they are not yet sufficiently good to warrant the general adoption of the method. The treatment of malignant diseases by colloidal metals dates back to 1904 when Torres advocated their use, although only a few observers took up the treatment. It was revived again in 1912 with the hope that it might stimulate the autolytic ferments which Neuberg and others believed were unusually active in neoplastic cells. The results, however, as expressed in cures, have been practically negative with colloidal silver, copper and gold. As has been shown above, Blair Bell believes that cancer cells have much resemblance to the trophoblastic cells seen in the earliest chorionic epithelium. The sensitiveness of chorionic epithelium to lead is well known. Necrosis rapidly ensues upon contact. Bell's clinical observations with lead poisoning in pregnancy and his experimental work with injection of lead into pregnant animals prompted him in 1920 to undertake the treatment of human cancer with colloidal lead. The treatments are always supplemented with deep Roentgen ray.

The pathologic lesions that have followed the injections of the colloidal lead in tumor-bearing animals are characteristic, although one must be cautious in translating the results of animal experimentation to human pathologic conditions. In general, there is injury to the capillaries of the tumor with thrombosis and subsequent hemorrhage and necrosis of the growth. It would appear that the lead (a particulate matter) is taken up after injection by the reticulo-endothelial system, and thereafter put out in soluble form; it exerts its toxic action first on the cells of this system and later on those of the neoplasm. Much more work, however, is necessary before we have a complete and accurate knowledge of the details of the mechanism. The final picture is a fibrosis which surrounds the atrophied or degenerated cancer cells and which finally obliterates them.

Bell reported his results in 1926. His series consisted of 227 patients who had been treated since 1920, 50 of whom have lived from one to five years in a completely arrested stage in spite of the fact that all of them were hopelessly advanced cases. The series included nearly all types of malignancy. His preparation was made as follows: To Bridig colloid in 0.4 per cent aqueous gelatin is added 0.027 per cent of calcium chlorid; the final product is centrifugalized to get rid of particles larger than 0.2 micron, is made hypertonic by the addition of 1.15 per cent sodium chlorid, 0.05 per cent potassium chlorid, 0.05 per cent calcium chlorid, and is then sterilized by boiling. The preparation is black or gray, depending upon the amount of hydroxid or carbonate which it contains. After two or three days it becomes toxic and must be rejected. The strength is checked by a colorimetric method and injections are made intravenously in quantities not to exceed 0.1 Gm. of lead per dose. During the two or three months that are required for the treatment, about 0.6 Gm. are given. When possible, part of the tumor is removed surgically before inauguration of the lead treatment. Meland, [142] in a discussion of

papers by Wood and by Ullmann at the American Medical Association, May, 1927, says that Bell recently cut the dose down to 50 Mg.

The metal is so toxic that cases must be selected carefully for treatment, to include none who have any signs of nephritis or jaundice, anemia or cachexia or metastatic involvement of the brain. A marked anemia often follows quickly after the treatment and may be so great that blood transfusions are indicated. Frequent urinalyses are necessary while the treatment is in progress, as are daily blood-counts. Stippling of the red cells is an early sign of a dangerous toxic condition.

The treatment thus far has been attended with considerable primary mortality, since the lethal dose must be approached in order to affect the tumor. For this reason it should be limited to such institutions as are properly equipped to carry it on and record truly scientific observations. The question of dosage is a vital matter. The London letter in the *Journal of the American Medical Association,* printed October 22, 1927, page 1438, records a case treated by Blair Bell in the Birmingham General Hospital, who had been returned almost to normal health after eight injections given for an inoperable cancer. During the treatment the growth shrank in size from the size of a man's fist to that of a hazelnut. After the ninth treatment, she developed toxic symptoms and died a few days later. A necropsy was performed and revealed the presence of a small quantity of lead. Less than 0.1 Gm. was found and probably 10 per cent of that represented the overdose. At the inquest Francis Lamb, pathologist to the Cancer Research Committee, agreed that the woman would not have died had she not received the last injection. The coroner in returning the verdict, "Death from fatty degeneration of the liver probably due to lead poison," said that the treatment had been properly administered.

A small group of other men have presented their observations with this treatment in sarcoma and carcinoma. The fact that they are not enthusiastic about its possibilities indicates comparatively little since the treatment is still in the experimental stage. From the reports of those who have used the method, we cite the following:

Martland, [143] in 1926, reports with other cases one of an inoperable uterine carcinoma. The patient was injected with a total of 653 Mg. of lead. The growth of the disease was not checked nor was lead found in the tumor tissues at time of autopsy. Ullmann,[144] at a meeting of the Radiological Society of North America, December, 1926, recorded the methods by which he was able to make a solution of lead which would keep long enough to be sent for use to others. All stages of the preparation were carried out under a layer of mineral oil—sparking, centrifugalization and sterilization up to the moment of injection. The solution was kept on ice from the moment sparking began until the boiling point just before injection. With this technic, a product was obtained which was sufficiently stable to last for several days. Without the precaution, the preparation broke down in from a few hours to a day or two. More recently, his chemists made a preparation which lasted from a few weeks to several months by adding 5 Gm. of glucose per liter to

the gelatin solution instead of calcium which was found to be not only unnecessary but detrimental. The polyhydroxy compounds thus introduced markedly inhibited oxidation and precipitation of the colloidal lead solution. Ullmann believes that the treatment should be confined to people with good kidney function and high hemaglobin, since the former was reduced at least 50 per cent in some of his cases even after the first injection, and the hemaglobin fell from 100 to 30 per cent in one case within a week, and from 78 to 28 per cent in another; while the red blood-cells fell from 4,400,000 to 2,200,000 and from 4,700,000 to 2,200,000 after one dose of 90 Mg. of colloidal gold. These marked blood changes were not an invariable sequence, one other case showing a fall from 86 to 76 hemaglobin although the cell-count fell from 5,200,000 to 2,600,000 after a dose of 352 Mg. in four weeks; yet he was unable to determine why this great drop occurred in some cases and not in others or to foretell which was to show most profound changes. The changes were so marked, however, that in May, 1927, they abandoned the treatment and utilized the colloidal lead phosphate which Bischoff and Blatherwick [162] had prepared as a substitute for the colloidal metallic lead. The preparation is as follows:

Colloidal tri-lead phosphate and 20 grams of commercial gelatin are dissolved in 500 c.c. of warm water. The solution is heated just below boiling and 5 grams of lead chlorid C.P. (3.7 grams lead) are added. To this solution is added drop by drop within the course of an hour a solution of 4.6 grams crystallized tri-sodium phosphate in 500 c.c. water. The lead solution is kept warm and agitated throughout the reaction. When about 90 per cent of the phosphate solution has been added, samples are taken from time to time and tested with brom-thymol blue indicator for the P^H. When neutrality is reached, the phosphate is added more slowly. When a P^H of 7.4 is reached, the reaction is complete. The total volume of the solution is then taken. It is centrifuged. A trace of insoluble material usually settles out during centrifuging. The lead content is calculated from the volume of solution, assuming that all the lead is in colloidal solution. It is about 0.40 per cent. The preparation does not remain sterile like colloidal metallic lead. It has been the practice to bottle the colloidal lead phosphate solution in 30 c.c. vaccine bottles. These are then sterilized by heating at 80° C. for one hour. The preparation keeps indefinitely. It forms a gel at a low temperature but remains perfectly liquid at room temperature.

Ullmann,[144] in 1927, states that the colloidal lead phosphate does not appear to affect to any marked degree either the hemoglobin or kidney function; but does have a definite effect upon certain tumor cells by increasing their sensitiveness to irradiation. He feels that the proper dosage has not yet been solved and that it is a vital issue, because a correct dose should be just sufficient to produce regression of the tumor to bring it within the action of the Roentgen ray while causing a minimum lead intoxication. He believes that it will be possible to mobilize the lead stored in the bones after the first course of treatment so that the tumor may be releaded without injecting more of the metal.

Wood,[163] in 1927, also feels that the action of lead in cancer cases is solely a toxic one which increases the radiosensitiveness of certain tumors to such a degree that it may be possible to destroy it by Roentgen rays. That is to say, the lead poisons the tumor to a certain extent and the Roentgen ray carries the destruction still farther. Certain tumors, however, are radioresistant and are beyond the range of present radiation therapy whether combined with lead treatment or not. He quotes the large series of experiments by Holthusen and others who doubt the possibility of such minute amounts of metal as can be injected acting as a radiator of secondary rays. He summarizes the result of his experiments as follows:

1. The combination of lead and Roentgen ray is more effective than either alone on a rat carcinoma of high virulence.

2. On a rat sarcoma of still greater growth capacity no such increase in the effectiveness of the Roentgen ray can be observed.

3. A preliminary study of the effects of the addition of dextrose to the lead mixtures or of preliminary injections of dextrose followed by lead, has shown that the dextrose does not seem to increase the efficacy of the lead in its action on tumors, nor does it apparently increase the efficiency of the Roentgen ray.

Meland obtained no good results in his series of 18 cases. Stone and Craver in September, 1927, record their experience with 56 injections of 21 cases at the Memorial Hospital, New York. Regression changes occurred in 8 of 27 tumors which were also treated with radium or X-ray.

The above, however, indicates little to the authors save that the method is being investigated. No one can review the cancer literature without being convinced that neither surgery, radium, nor Roentgen ray will ever solve the cancer problem. Other methods must be evolved which will prove more successful.

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GYNECOLOGICAL AND OBSTETRICAL TUBERCULOSIS

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TUBERCULOSIS OF THE KIDNEY

Tuberculosis of the kidney occurs in two distinct forms: (*a*) as a part of the general miliary tuberculosis and (*b*) the so-called primary renal tuberculosis. The renal involvement is generally of comparatively minor importance in the first variety. The former variety is not included in the following study.

Renal tuberculosis is practically always secondary. The primary lesion may be small, quiescent, and difficult or impossible to recognize clinically. The fact that the condition is secondary and a part only of a general infection, has an important bearing upon the prognosis and treatment.

Much advance has been made in recent years in methods of diagnosis and treatment, and the knowledge that chronic renal tuberculosis is always a surgical disease is now recognized. Medical treatment alone is rarely, if ever, successful, but combined with proper surgical procedure, is of the utmost importance.

Renal tuberculosis still presents many unsolved problems. The pathologic changes incident to early renal tuberculosis have been studied experimentally but are still somewhat in doubt. The fact that early renal tuberculosis gives rise to no symptoms or only vague clinical manifestations is regrettable, and it is to be hoped that in the future a method may be developed which will enable recognition during the incipiency of the disease.

As has been intimated, the term primary renal tuberculosis is generally employed in a clinical rather than etiological sense. Morgagni and other writers described renal tuberculosis but the mode of infection was misunderstood. Prior to the surgical era the disease was generally described by the pathologists who saw advanced bilateral lesions with extensive vesical involvement and often invasion of other organs. The condition was thought incurable. Probably owing to the prominence of the vesical symptom it was believed that the infection was an ascending one. In 1871, Simon, by the performance of nephrectomy, did much to stimulate the successful treatment of renal tuberculosis. The period between 1878 and 1893 saw great improve-

ment in the methods of diagnosis and during the last decade of the twentieth century the operation of nephrectomy was perfected and became widely employed.

Etiology.—Renal tuberculosis is usually caused by the human variety of the tubercle bacillus. The bovine tubercle bacillus is of less frequent occurrence. In the early stages of the disease the condition is generally due to the tubercle bacillus alone, but in the later stages mixed infection, particularly with the colon bacillus and the ordinary pyogenic organisms, is of frequent occurrence.

Various conditions have been thought to be predisposing factors to renal tuberculosis; among the most commonly assigned being ptosis, hydronephrosis, renal calculus, pregnancy, heredity, acute nephritis, chronic nephritis, gonorrhea, trauma, congenital malformations, chronic pyelitis, cystitis, urethritis, hypernephroma and any condition that produces urinary stasis, such as hypertrophy of prostate, stricture, and allied conditions.

Ptosis.—It has been suggested that kinking of the ureter, increase in intrarenal pressure and interference with the circulation of the kidney, may be predisposing factors. However, clinical studies do not bear out this assertion. Renal ptosis is much more common in the female than in the male, but whereas statistical studies do show a greater frequency of renal tuberculosis in the female, the proportion is not marked.

Hydronephrosis.—It is doubtful what part hydronephrosis plays as a predisposing factor to tuberculous infection. Stasis and intrarenal changes in pressure are, theoretically at least, causative factors. From a practical standpoint it is often difficult to determine whether or not the hydronephrosis actually preceded the tuberculosis or was the result of it.

Pregnancy.—Renal tuberculosis in association with pregnancy is not infrequent. It is recognized that pregnancy often produces an exacerbation of previously quiescent tuberculous lesions, especially those in the lungs, and that a bacillemia not infrequently results. It also frequently produces a stasis and renal congestion. All these are factors which would appear to favor a renal involvement.

Heredity.—Renal tuberculosis is most common in middle life. Undoubtedly there is a predisposition to tuberculosis in general, but the part played by it in the production of renal tuberculosis is probably slight.

Acute and Chronic Nephritis.—The theory that acute and chronic nephritis are predisposing factors to renal tuberculosis rests only upon theoretic grounds.

Gonorrhea.—Gonorrheal pyelitis is such a rare condition as to be almost negligible as far as being an important predisposing factor to renal tuberculosis. Preëxisting gonorrheal infection is probably a definite predisposing factor to tuberculous salpingitis and it is probably a predisposing factor in the kidney.

Trauma.—In some instances trauma has apparently played a predisposing part in the development of renal tuberculosis. Owing to its protected location the kidney is rarely exposed to this insult. Experimental research apparently indicates that trauma acts as a predisposing cause.

Congenital Malformation.—A study of a large series of cases seems to show that tuberculosis is more frequent in kidneys which are the seat of congenital malformations, especially of the lobulated variety. This is in accord with the findings regarding tuberculosis elsewhere in the body.

It is generally stated that tuberculosis of the kidney may be primary or secondary and may result from an ascending or descending infection, or in rare instances from direct extension from adjacent foci. A few cases of apparently true primary renal tuberculosis are on record. Opinions differ regarding the existence of even these and many close observers believe that this is never the case.

Certainly true primary lesions are extremely rare and are of interest from a theoretic rather than a practical standpoint. All cases should be treated as if secondary. The infection is usually hematogenous and descending in type. Occasionally infection may occur via the lymphatics. The infection may be an ascending one by way of the urogenital system and may occur by continuity from adjacent foci such as tuberculosis of the adrenals, spine, pleura, intestines, peritoneum, etc. It is at least theoretically possible that the old theory of ascension from the bladder via the ureter or periureteral lymphatics may occasionally occur. Brown (Osler's *Modern Medicine,* 1919, Vol. VI, p. 274) points out that many cases have been regarded as ascending infection because of the advanced development of the lesions in the papillæ, the pelvis, or the ureter, but this argument is fallacious because the changes in the medulla are often secondary to some primary focus in the cortex, although the medullary lesion may develop more rapidly, affect the renal pelvis and ureter, and produce the appearance of greater age. It is also quite possible for a hematogenous infection to be primary in the pyramids or pelvis.

Primary vesical tuberculosis is extremely rare. Young (*Phila. Urol. Soc.,* Jan. 26, 1925) states that he has never seen a case. The true primary focus of renal tuberculosis is most commonly pulmonary or intestinal and less frequently from the lymphatic glands, fallopian tubes, or osseous system.

The passage of tubercle bacilli through the kidney without causing a lesion is important. It is well known that the mere demonstration of tubercle bacilli in the urine is insufficient evidence upon which to base the diagnosis of genitourinary tuberculosis. Cunningham, Brown, Crabtree, and others have reported such occurrences. It has been found that tubercle bacilli are sometimes secreted in the urine in cases of pulmonary tuberculosis in which there is no demonstrable renal lesion. Whereas the presence of tubercle bacilli in the urine is strong presumptive evidence of urogenital tuberculosis, unless pus and other evidence is also present, it is not conclusive. The presence of predisposing factors, the number and virulence of the tubercle bacilli reaching the kidney, the local and general resistance of the individual, are probably the determining points as to whether or not a renal infection develops in these cases.

Pathology.—The methods by which the tubercle bacillus may reach the kidney have been enumerated. There is nothing in the macroscopic or histologic study of renal tuberculosis which will with certainty determine the mode of infection nor can the initial renal lesion be positively differentiated. Ex-

perimental evidence which is confirmed by histologic and clinical study, however, shows that generally the tubercle-bearing emboli find lodgment between the cortex and medulla near the base of a pyramid. Crabtree (Cabot's *Modern Urology*, 1924, Vol. II, p. 530) states that most of the tubercle bacilli which reach the kidney through the renal artery, are arrested in glomeruli. Some few escape from the capillaries of the glomeruli by the efferent blood stream and may be enmeshed in the complex venous channels which surround the tubules or descend with them toward the pelvis. They may also lodge in the area supplied by the arterioles originating directly from the renal artery.

Many classifications of renal tuberculosis have been made. Israel divides the lesions into three groups: (*a*) Phthisis caseosa, often associated with peri- and para-nephritis and frequently developing into pyonephrosis; (*b*) ulcerations of the tips of the papillæ, less frequent but often productive of hematuria; and (*c*) a chronic disseminated variety somewhat resembling the acute miliary type except that the disease is unilateral and the tubercles larger and necrosis and caseation more definite. Proliferation of the epithelium and endothelial cells are characteristic and early changes. The degree of small round-cell infiltration is variable. In the center of the tubercles fat formation occurs, followed by breaking down of the cells. Tubercle bacilli can be demonstrated in the tubercles and are most common near the periphery. The pathologic picture varies with the duration of the disease. Specimens may be observed in which the lesion is limited to a few small tubercles and vary from this to destruction of the entire kidney and involvement of adjacent structures.

The disease is a progressive one. The most commonly observed macroscopic picture in specimens removed by operation is one or more small caseous areas, a centimeter or more in diameter. This is most often in a pyramid. The caseous area contains flaky, greenish or yellowish pus and the wall is shaggy. Often one lesion is considerably larger than another. These lesions are generally buried in the substance of the kidney but may project under the capsule. The ureter is usually thickened and as the disease advances, the caseous areas increase in size and two or more may coalesce so that it is not uncommon to find one pole of the kidney entirely occupied by such a lesion. In advanced cases the entire renal tissue may be destroyed and the kidney converted into an abscess sac surrounded by the capsule, which, even in the terminal stage of the disease, tends to retain its integrity.

Tuffier has described a form of massive degeneration combined with occlusion of the ureter in which the entire kidney is destroyed and but little enlarged. As a general rule considerable enlargement is present in the advanced stages. When the renal pelvis is involved the mucosa is reddened, thickened, roughened, has lost its sheen and may show more or less definite ulceration in varying degrees, which is likely to be on the lateral aspects of the papillæ. Tubercles may be demonstrable macroscopically.

In the early cases the cortex appears normal but may contain macroscopic tubercles. In the later stages, the so-called ulcerocavernous type, the kidney is generally enlarged, congested, and a collection of tubercles is often visible beneath the capsule. More or less extensive ulceration is present, especially of

the papillæ; adhesions to the capsule and about the pelvis are common. When the cortex is involved, adhesions to the fatty capsule may be extensive.

If obstruction of the ureter occurs a pyonephrosis follows. The organ is generally enlarged and lobulated; the kidney tissue is thinned. Not infrequently pyonephrosis develops, even when no obstruction can be demonstrated, and has been accounted for by disease of the walls of the pelvis and ureter, which become lax and dilate easily. Loss of tone appears to be the cause in some of these cases; occasionally, in extremely advanced cases, the entire kidney is destroyed, the ureter completely blocked, the blood supply shut off, and the contents of the capsule becomes thickened and inspissated with calcium salts producing a light-grayish putty-like material.

This condition has been termed autonephrectomy. Even such "dead" kidneys have been found to contain virulent tubercle bacilli. Occasionally specimens are encountered which contain more or less cicatricial tissue, apparently the result of an attempt by nature to cure the condition. Active lesions are always present in these kidneys, which are often small and adherent. Crabtree terms them sclerous tuberculosis.

Much has been written, especially by the earlier writers, concerning spontaneous healing of renal tuberculosis. The writer has never seen such a specimen, and a moderately extensive search through the literature has failed to reveal an authentic case. This is of importance in regard to the treatment. The fact that active, although often microscopic tubercles are present, even in kidneys in which attempts at healing are evident, is the strongest argument against nephrotomy or resection of a part of the kidney.

When tuberculosis develops in a malformed kidney of the double type, one pelvis is generally macroscopically invaded, and the cortical portion of the other organ often contains microscopic evidence of infection.

The histologic picture produced in tuberculosis of the kidney is in general similar to that resulting from a like infection elsewhere. The tubercle bacillus is generally arrested in the glomerula near the medulla and tubercles develop at this point. The amount of chronic inflammation is variable and often not marked even in advanced cases. The tubercles develop, coalesce, and form nodules which undergo caseation, which in turn is probably due to the toxins produced by the tubercle bacillus.

The toxins injure the cells in which fatty changes occur. This is followed by death and disintegration of these structures. Calcium from the blood stream is deposited, and leads to chemical changes which are said to result in the formation of calcium soap from the combination of fatty acids.

The larger tubercles may be distinguished macroscopically as grayish, whitish, or yellowish areas with softened centers. These may be discrete and scattered through the medulla or cortex, but more frequently coalesce forming cavities of varying size. When the pelvis of the kidney is invaded and there is free drainage, there is generally less enlargement of the kidney than when obstruction occurs.

Obstruction usually occurs sooner or later and in most instances of moderate advancement more or less enlargement of the kidney is present.

When involvement of the pelvis has occurred, the ureter becomes infected, tubercles form, followed by caseation and ulceration; the ureter becomes thickened and infiltrated, and in a short time bladder involvement develops by direct extension from the ureter. Stricture of the ureter or entire occlusion of the ureteral lumen may occur, or the lumen become temporarily blocked by detritus. Dilatation and stricture are common in advanced cases. In specimens of renal tuberculosis removed by nephrectomy the ureter is nearly always involved and in postmortem specimens, almost routinely.

When secondary infection by pyogenic organism takes place, the symptoms are intensified; active, inflammatory reactions occur, and the kidney may be converted into a huge abscess sac with little or no renal tissue remaining. With the addition of pyogenic organism the integrity of the capsule is prone to be destroyed, and perinephritic abscesses result. Perinephritic abscesses are much more likely to develop when mixed infection occurs than when the tubercle bacillus is the only organism present. In some specimens there is a predominance of scar tissue in the fibrous capsule and the surrounding fat or typical tuberculous lesion may be observed.

Tuberculosis of the ureter and bladder is nearly always secondary to renal tuberculosis. When the renal pelvis becomes involved, a descending infection follows, and the symptoms resulting from this are generally more marked than those produced by the kidney lesion. Fortunately, the ureteral and vesical lesions tend to heal after nephrectomy. The infection is by contiguity and extends along the submucosa; from here extending to the muscularis and perireteral tissue and to the mucosa.

In advanced cases the fat surrounding the pelvis contains tubercles. As might be expected from a descending infection, vesical tuberculosis develops primarily about the ureteral opening, which is reddened and swollen and may show macroscopic ulcers or macroscopic tubercles.

The chief vesical lesion is about the ureteral opening, but from here the disease may spread and in advanced cases invade the entire bladder. The apparent immunity of the bladder to the action of the tubercle bacillus is remarkable, and even in advanced cases observed at necropsy, the ureteral orifices and adjacent bladder walls are often the only areas affected. This is in accord with the rarity of so-called primary vesical tuberculosis. The characteristic appearance of vesical tuberculosis is of the utmost value in the cystoscopic examination.

Except in the miliary variety, renal tuberculosis is nearly always unilateral in its incipiency, and generally it is only in the late stages that the opposite kidney is involved. The route by which the second kidney becomes infected is somewhat in doubt. Metastasis from the primary affected kidney, ureter or bladder, or from the true primary focus has been suggested. Naturally, statistics vary widely regarding the frequency with which the second kidney is involved and depend largely upon the type of material utilized. Postmortem records show a high proportion of bilateral renal tuberculosis whereas those formulated from operative material present the reverse aspect. Halle and Morz

(*Ann. d. mal. d. org. genito-urin.*, Par., 1906, 24:241) in necropsy material found 42 of 131 cases of renal tuberculosis to be bilateral.

Brown (*loc. cit.*) quotes from Douglas, Bevan, Albarran, Morabeau, Krönlein, Israel, Krummel, Flackman, and Kuster, whose combined statistics show unilateral lesions in 83.66 per cent. Other authorities present even more favorable figures. The experience of the writer is that at least 90 per cent of cases are unilateral that come for operation provided that ordinary diagnostic skill has been exercised in the recognition of the condition.

When bilateral renal tuberculosis is present similar types of lesions are usually observed. However, one kidney nearly always shows greater advancement of the disease. Numerous cases of renal tuberculosis occurring in conjunction with calculi have been analyzed but it is questionable if the percentage of such cases is greater than could be accounted for by the disease incident to the condition. Generally the stone precedes the tuberculosis and upon theoretic grounds at least may be supposed to be a predisposing factor to the latter.

Walker (*Ann. Surg.*, 1907, 14:249, 388, 597) in a series of 218 cases found the right kidney diseased in 111, and the left in 98; in 9 the affected side was not stated. These figures closely approximate those given by most observers.

Chronic renal tuberculosis may lead to a toxic nephritis of the opposite kidney which generally clears up promptly after nephrectomy. In some cases this is entirely a functional condition; in others, particularly those of long standing, a chronic parenchymatous nephritis develops with its usual symptoms and urinary findings. A comparative degree of compensatory hypertrophy in the normal kidney is prone to occur.

Symptoms.—Statistics are quite variable in regard to the bearing which sex plays in the development of renal tuberculosis. G. Walker's series (*loc. cit.*), in 386 patients, 204 were females. In the same series the average age was 27.66 years. In our much smaller series the average age was 35 years. The disease is therefore most frequent in adult life.

Although pregnancy frequently exerts an unfavorable influence on pulmonary tuberculosis and results in an exacerbation and tuberculous bacteriemia, childbearing apparently plays no appreciable part in the development of renal lesions and the disease is relatively as frequent, at least in small series, in the nulliparous as in the multiparous. A family history of tuberculosis or of exposure to the infection is frequent but may be absent. Careful questioning will often elicit a history suggestive of tuberculosis elsewhere in the body; a history of susceptibility to "colds," pleurisy, chronic lung lesions, chronic abscesses, persistent sinuses, adenitis or even of chronic peritonitis is not infrequent. A thorough examination of the lungs should be made by an experienced internist in every case.

The clinical evidence of a true active primary lesion is often lacking at the time of the development of the renal symptoms. Indeed it is not uncommon in cases of renal tuberculosis to be unable to determine the true primary focus. Renal tuberculosis in its early stages produces few and mild symptoms, and this is unfortunate, as the earlier the diagnosis can be established and nephrec-

tomy performed, the better is the prognosis. A thorough investigation will often show that for some time the patient has been below par, that there has been malaise, poor appetite, a feeling of warmth or feverishness, especially in the late afternoons or evenings, and poor sleep.

In the early stages of the disease, constitutional symptoms vary markedly in different cases but are generally absent or so insignificant as to escape notice. Fever was present in but 22 per cent of Israel's cases of uncomplicated renal tuberculosis and in 80 per cent of those in which the bladder was involved. After extensive caseous areas have developed or in the presence of a mixed infection, hyperpyrexia is generally the rule. A slight evening rise of temperature is always significant; loss of weight, anemia, hyperpyrexia, exhausting sweats, and other evidence of toxemias are late symptoms. Digestive disturbance, nausea, vomiting, diarrhea, constipation, anorexia, rapidity of the pulse, anemia, may occur early but are generally of late occurrence. Pain depends upon the stage and type of lesion present. In the early stages it is almost a negligible symptom. Hypotension has been observed and thought to be of value as a diagnostic sign.

Tenderness over the region of the kidney is of frequent occurrence and may develop moderately early. Later when the ureter is affected tenderness in that structure is generally present. Palpation of the ureter in its lower portion and especially as it crosses the pelvic brim and as it passes through the parametrium to enter the bladder, as elicited by a vaginal examination, is a valuable diagnostic sign. The thickened and cordlike ureter may often be palpated by this method. Such ureters are sometimes referred to as pipestem or rosary-like, according to whether the thickening is uniform or nodular.

Crossed or referred pain may develop. This is a pain which occurs in the uninfected kidney; it is the result of swelling or compensatory hypertrophy of the kidney and consequent stretching of its capsule. It is prone to occur in rapidly advancing cases, and in those in which there is obstruction to the outflow on the affected side. It is of importance in that pain in the supposedly normal kidney does not necessarily infer a bilateral infection. The pain in the affected kidney is generally of a dull aching character or may be only a feeling of pressure. As obstruction begins, colicky attacks develop, generally in the affected area but sometimes referred along the course of the ureter. When vesical involvement is marked the thickened bladder can be easily felt upon bimanual examination. When the bladder becomes affected dysuria and frequency become prominent symptoms and are usually at first most marked at night. Vesical irritation is often the first symptom which induces the patient to seek medical aid. Such symptoms should never be overlooked or treated empirically until a thorough investigation of the case has been made. It cannot be too strongly emphasized that not infrequently these are the first severe symptoms from which the patient complains and the possibility of a tuberculous nephritis being present should always be borne in mind by the attending physician.

In not a few cases the diagnosis of uncomplicated cystitis is made and the true nature of the condition not recognized until the disease is hopelessly

advanced. Some writers, recognizing the mildness of the early symptoms resulting from renal tuberculosis, divide the disease into four stages: (1) Early, when symptoms are absent or almost silent, (2) involvement of the pyramids and ureter, (3) the vesical stage, and (4) when bilateral infection has occurred. As has been intimated, the symptoms vary widely with the individual case and with the stage of the disease. As a rule the diagnosis is not easy or may be impossible in the early stage and is generally quite apparent during the later development of the condition. Palpation will generally show some tenderness even in the early stage of the disease; later the kidney may be enlarged, especially if obstruction has occurred. Enlargement of the kidney is more easily recognized upon the right than on the left side. In about one-half the cases coming to operation the enlargement of the kidney can be recognized by palpation. Definite local swelling is generally indicative of hydronephrosis, pyonephrosis or paranephritic abscess.

Leukocytosis is generally absent unless a mixed infection is present. Renal tuberculosis usually runs a chronic but progressively unfavorable course. Remission of symptoms may occur for varying periods, especially in the early stages of the disease and sometimes leads to the fallacious hope that the condition has been relieved by medical treatment, or in the unrecognized cases, that local applications to a supposed cystitis have proved effectual. These remissions are caused by the free drainage of a hitherto troublesome caseous area and comparative freedom from symptoms continues until new lesions develop or a light-up of the earlier area occurs. The remission of symptoms both local and general is characteristic of renal tuberculosis; intervals of entire absence of pain, gain in weight and absence of renal symptoms are of frequent occurrence.

Tuberculosis of the kidney may develop during the course of pregnancy, or pregnancy may occur during the course of a renal tuberculosis. There is little doubt that pregnancy exerts an unfavorable influence on the course of the disease. Not only is this true of tuberculosis in general, but in these cases the congestion produced by the pregnancy and the added strain which is thrown on the kidneys incident to gestation, act deleteriously.

It is unwise to attempt anything but generalities regarding the treatment of the pregnant tuberculous woman. In the early stages of pregnancy complicated by renal tuberculosis, therapeutic abortion is often indicated. Whether or not this should be done should depend upon the condition of the patient and the advancement of the renal lesion. At all events the nephrectomy should not be delayed on account of the pregnancy and the emptying of the uterus is generally advisable.

If it is decided to terminate the pregnancy, the same methods advised in the chapter on Pulmonary Tuberculosis and Pregnancy are advisable. Very early pregnancy may be successfully interrupted by dilatation and the use of placental forceps. From the sixth week on, however, vaginal hysterectomy, especially in the multipara, and when the cervix can be brought well down, is the method of choice.

This operation may be quickly performed. There is little loss of blood

and convalescence is generally extremely rapid and smooth, and is uncomplicated by bleeding and the necessity for repeated uterine packing. It can be performed at the same time as the nephrectomy, if the condition of the patient warrants the slight prolongation of anesthesia incident to the procedure.

More or less the same advice holds true from the fourth to the sixth or seventh month; as the nephrectomy itself may produce abortion or premature labor, this consideration should be borne in mind. Towards the end of pregnancy it may be advisable to delay the nephrectomy a few weeks in the interest of the child, but as a general rule the pregnancy should be disregarded and the renal tuberculosis treated as if pregnancy did not exist. If there is hope of saving the child gradual dilatation of the cervix may be resorted to and the nephrectomy and delivery by forceps or version performed jointly.

Subsequent to nephrectomy for tuberculosis, it is generally inadvisable for patients to become pregnant. No hard and fast rules should, however, be formulated. It should be remembered that, entirely apart from the added burden on the remaining kidney incident to pregnancy, these patients are tuberculous, and even though the focus is quiescent, the physiologic changes incident to pregnancy may be sufficient to produce an exacerbation.

Borelius (*Monatschr. f. Geburtsh. u. Gynaek.*, 1924, 67: 327-393) reports the results in cases of pregnancy after nephrectomy. He believes there is no evidence of increased frequency of abortions after nephrectomy and that an existing pregnancy does not contra-indicate nephrectomy.

Urinary Symptoms.—As already stated, not infrequently the first indication of the presence of renal tuberculosis is frequency, urgency, dysuria, polyuria, pyuria, hematuria, and symptoms suggestive of vesical irritability. Frequency is the most commonly observed symptom. Especially in advanced cases, vesical irritability is marked, and tortures the patient day and night, making life almost unendurable. Roberts has recorded the history of a patient who voided 180 times daily and in whom the bladder was only slightly involved.

Pyuria, sometimes intermittent, due to blockage, is a symptom of the utmost importance. Frequency and pyuria, especially in conjunction with a comparatively normal bladder, is especially significant. Patients often notice the cloudy appearance of the urine and remark upon its changes from day to day. The pus from a tuberculous kidney is grayish and granular and gives the urine a ground-glass appearance in contrast to the soft yellowish pus produced by most other conditions. As caseation advances in the open lesion, pyuria becomes marked and as fragments of the detritus produce blockage, colic develops, sometimes not unlike that caused by a calculus. If the blockage is complete or other occlusions of the ureter develop, there will be a temporary cessation of the pyuria or a marked lessening of the amount of pus. A small amount of pus may be present in the urine, due to lesions below the point of blockage. Naturally, much depends upon the stage of the disease and the character of the renal lesion as well as upon the condition of the ureter and bladder. The presence of pyuria, at least in the early stage, depends upon whether the lesion involves the pelvis or calices. Large quantities of purulent material in the urine generally indicate that a mixed infection is present

Hematuria or a few red blood-corpuscles in combination with pyuria is of frequent occurrence and is an important symptom. Macroscopic hematuria may be present, especially if the apices of the papillæ are involved. Macroscopic and even microscopic hematuria tends to be intermittent. Sometimes clots produce blockage and colic and complete casts of the ureter have been observed. Occasionally macroscopic hematuria is the first symptom. Cases have been recorded in which no blood has been demonstrable in the urine. Polyuria is present in many cases and may be intermittent in type. The urine is of a low specific gravity. Albuminuria in correspondence with the amount of pus or blood or due to an associated nephritis is present. Casts are often lacking. They were observed in 10 per cent of Hunner's cases. Hyaline and granular casts are the most frequent.

Casts are indicative of a nephritis; they may have their origin in the non-tuberculous kidney. The urine is acid in all stages of renal tuberculosis, unless vesical involvement is present, or a mixed infection has occurred. Hence in the early stages it is nearly always acid. Particles of cheesy material, friable detritus, elastic fibers, are of frequent occurrence in the urine. Incomplete retention and spasmodic incontinence may occur. In tuberculosis of the kidney the bladder urine may be sterile in ordinary culture-media, even though considerable pus is present. This is itself a suggestive sign of tuberculous nephritis. A mixed infection may be misleading and tend to obscure the correct diagnosis.

The demonstration of tubercle bacillus in the urine is the most important single symptom in the diagnosis of renal tuberculosis. That it is not absolutely diagnostic, however, has already been stated, as in certain conditions tubercle bacillus may be passed through the normal kidney. The presence of tubercle bacilli and pus in specimens secured by ureteral catheterization is, however, conclusive. The importance of the test for these organisms is therefore apparent. The tubercle bacillus must be differentiated from the smegma bacillus which is morphologically and tinctorially nearly similar.

The most certain method of demonstrating the tubercle bacillus is by guinea-pig inoculation, but this has the disadvantage of being time-consuming, and although the Block method considerably shortens this period, the necessary wait incident to even this procedure may be inadvisable. Whatever method of diagnosis is employed, animal inoculation should always be performed and a number of animals should be utilized. It is unsafe to rely upon a single or even two animals. An accidental infection may occur or a single pig may die shortly after inoculation.

Loewenstein in 1913 and later Hyntschak (*Wien. klin. Wchnschr.*, 1924, 37: 336) have pointed out that renal tuberculosis may result from the tubercle bacillus of fowls and that this organism is not pathogenic to guinea-pigs. These authors emphasize the importance of cultures by the Loewenstein method. Various cultural methods have been suggested for the demonstration of the tubercle bacillus: chief among them is that of Brown and Petroeff mentioned in a preceding chapter. A reliable cultural method would be of great value.

Barney, quoted by Cabot, states (*Modern Urology,* 1914, Vol. II, p. 552) the value of the animal test cannot be doubted and is well shown by a series of 252 consecutive pig inoculations done at the Massachusetts General Hospital; of these 197 were definitely proved either positive or negative by operation, pathologic report, and autopsy or clinical course. Among these were two cases in which the pathologic report showed tuberculosis of the kidney and the pig test was negative. In one of these there was complete obliteration of the ureter. In the other there was a tuberculous nephritic abscess but the pig test was negative. Leaving out the first of these cases the pig test was accurate in 99.5 per cent of the 197 cases.

It is a good practice to look for tubercle bacillus in every acid, apparently sterile, purulent urine as well as in all cases which present other suggestive symptoms. Bladder urine may be employed for animal inoculation. Tubercle bacillus may be demonstrated by staining methods from the bladder urine but the dangers of contamination, especially by the smegma bacillus, must be considered. In specimens secured by aseptically performed vesical catheterization the danger of contamination by the smegma bacillus is considerably lessened. The dangers of contamination by the smegma bacillus are somewhat greater in the female than in the male. The twenty-four-hour specimens are, however, more difficult to secure by this method. Urine secured by properly performed ureteral catheterization is almost sure to be uncontaminated, but the small amount obtainable is sometimes a detrimental factor. If tubercle bacillus and pus can be demonstrated in such urine by staining methods it is practically convincing proof of the existence of renal tuberculosis.

Ureteral catheterization should be employed in every suspicious case as well as the examination of the twenty-four-hour specimen. Properly performed ureteral catheterization is practically devoid of danger and certainly is productive of less risk than that incurred by failure to perform the operation and subsequent delay and doubtful results by other methods. It must be remembered that at times tubercle bacillus may be absent from the urine or present only in extremely small numbers, especially in the early stages of the disease, and that the failure to demonstrate the organisms by a single examination does not exclude the possibility of tuberculosis being present. Repeated tests should be made in suspicious cases. However, a competent bacteriologist will rarely fail to detect the tubercle bacillus if present. Cabot (*Modern Urology,* 1924, Vol. II, p. 552) states that at the Massachusetts General Hospital they have been strong believers in the accuracy of the guinea-pig test and until recently have relied upon it entirely.

Autonephrectomy, obliteration, and blockage of the ureter may at times produce periods when the tubercle bacillus may be temporarily or permanently absent from the urine.

Cystoscopic Examination and Ureteral Catheterization.—Modern cystoscopy is one of the most valuable methods in the diagnosis of renal tuberculosis and has revolutionized the former methods. Not only is it an aid to diagnosis but the procedure offers a method by which the extent of the

disease may be determined in the majority of cases. The various separators or segregators are unreliable.

Even in the hands of the experienced cystoscopist the cystoscopic examination and ureteral catheterization is not entirely without risk but this risk is extremely small. The perforation of a tuberculous bladder or ureter has been recorded. A suspected case, however, runs a far greater risk from delay than from the prompt employment of this method.

If marked vesical irritability is present the exhibition of sandalwood 0.9 c.c. for a few days prior to the cystoscopic examination may be beneficial together with the ingestion of a considerable extra quantity of water. In this connection it should be remembered that hexamethylenetetramin and its derivatives are often irritating in renal tuberculosis.

It is of great advantage to complete the cystoscopic examination at one sitting. Anesthesia is not generally necessary. A weak novocain may be employed if necessary. In nervous women morphin sulphate (¼ Gr.) may be given hypodermically half an hour before the examination. A general anesthetic is neither required nor advisable and hinders the examination in many respects. Cabot (*loc. cit.*) has occasionally employed spinal anesthesia.

The bladder should be thoroughly washed out as a preliminary step. The appearance of the bladder is often characteristic. In early cases it may appear normal. The ureteral orifice of the affected side generally appears reddened and swollen and tubercles may be seen as small grayish elevations surrounded by a reddened base. The tubercles exhibit a tendency to break down, resulting in irregular shallow ulcers, to which may be attached cheesy-like material. The trigon is often edematous or may be difinitely involved in the tuberculous process. Extensive tuberculous trigonitis is, however, unusual and rarely observed except in advanced cases. Due to infiltration, the action of the ureteral sphincter is sluggish. When the ureter is extensively involved its orifice tends to retract, due to thickening and edema. There may or may not be an associated ulcer. Sometimes this retraction is so marked that the affected ureteral orifice appears in the midline.

From inspection the experienced cystoscopist is often able to arrive at the diagnosis. It is needless to add this diagnosis should be verified by other means. Ureteral catheterization should be performed not only to determine the condition of both kidneys but to ascertain the condition of the ureters. The separate urines should be subjected to a rigid study.

It is essential to determine the condition of both kidneys. If one ureteral orifice is obviously diseased and the other appears normal it may be better, as a preliminary step, to catheterize only the apparently normal side. In advanced cases of tuberculous ureteritis, strictures, distortions or other abnormalities are prone to be present which may prevent the passage of a catheter, or the ureter may be so dilated that the urine escapes around the instrument. If the bladder and ureteral orifices are normal, or any doubt exists as to which is the affected side, both ureters must be catheterized. The same is true if both appear involved.

Ureteral catheterization, while most valuable, is not without its hazards.

The risk of carrying infected material from the bladder into a normal ureter, or even to the kidney, must be considered. This danger may be almost entirely eliminated by proper technic. To obtain renal urine it is not necessary to pass the catheter all the way to the kidney; a few centimeters are sufficient. Constitutional and local symptoms may follow even properly performed ureteral catheterization and a certain amount of malaise and discomfort is of frequent occurrence. The risk when proper technic is employed is at the minimum. The benefits to be derived from the method far outweigh its risks. Only by ureteral catheterization is it possible to determine with certainty the condition of the supposedly normal kidney and in other cases ascertain which side is affected.

As a general rule ureteral catheterization presents no particular difficulties, when the bladder is extensively involved, markedly edematous or ulcerated or when much cicatricial tissue is present even the experienced cystoscopist may have difficulty in locating the ureteral openings. Chromatocystoscopy may be resorted to. It takes ten to fifteen minutes for the coloring matter to appear, and this is a distinct disadvantage if the bladder is irritable, as it is likely to be in the type of case in which chromatocystoscopy is required. However, this disadvantage may be largely overcome by careful timing. The chromatocystoscopic part of the examination should be performed prior to the insertion of the ureteral catheterization, as the latter procedure may produce a ureteral spasm which is detrimental to the accuracy of the test. At the risk of repetition we would emphasize the importance of including all the cystoscopic work at one sitting. Tuberculous bladders are generally irritable and for this reason it is important to work as rapidly as compatible with thoroughness and to have no delays between the various steps in the examination. With this in view, the examination should be performed in a well-equipped cystoscopic room, aided by an assistant and a well-trained nurse. In cases of doubtful diagnosis Buerger has performed biopsy through the cystoscope and in this way has been able to establish a diagnosis.

The functional tests are of value in determining the condition of the supposedly normal kidney as well as the diseased one. Double ureters and other anomalies must be looked for. One remarkable specimen of this condition occurred upon the gynecological service at the University Hospital, in which the urine from one ureter was normal and from the other showed the usual evidence of tuberculosis.

Diagnosis.—In the early stage the diagnosis is often difficult and the lesion nearly silent. A careful review of most cases will, however, often show that some suggestive symptom has been present, even in the early stage, and in the preceding pages an endeavor has been made to emphasize the importance of these symptoms. All cases presenting suggestive symptoms should be subject to a thorough and, if necessary, repeated examination. Negative urine findings are not uncommon in the incipiency of the disease and this is the type of cases in which a second or even a third cystoscopic examination is required. As the bladders in this stage are not likely to be irritable there is less objection to a second cystoscopic examination in this class of patient than in those with

more pronounced lesions. During the later stages of the disease its recognition is generally easy.

X-ray examinations are of great value in arriving at a diagnosis and in excluding renal calculus. Calcified areas may simulate calculi. Tuberculous lesions appear denser than normal renal tissue. The amount of involvement is often determinable, to an extent at least, by the x-ray. The tuberculin test is employed by some urologists. The general reaction is of little value in the adult but the local reaction of pain in the renal area is suggestive. Renal functional tests are of much importance and one of these should be employed in every case. The phenolsulphonephthalein test is one of the best; the divided as well as the total function may be estimated. Probably the best plan is to employ both the phenolsulphonephthalein and indigo-carmine tests. Both can be utilized at one sitting. This combination gives a most accurate estimate. The conditions for which renal tuberculosis is likely to be mistaken are pyelitis, cystic kidney, calculus, hypernephroma and other malignant neoplasms, and essential hematuria. Calculi and neoplasms are most likely to cause confusion, but can be readily differentiated if proper means are employed. Having established the diagnosis no time should be lost in instituting treatment.

In rare instances when some insurmountable obstacle exists, such as ankylosis of the hip-joints, stricture, etc., it may be advisable to make a vesicovaginal fistula and catheterize the ureters through the opening, or even to perform an extraperitoneal exploration of the kidney.

Treatment.—The only satisfactory treatment for renal tuberculosis is nephrectomy. This operation is indicated in all cases as soon as the diagnosis is established, provided the disease is unilateral, that the functional tests show the opposite kidney in good condition and supposing no other contra-indications such as an advanced pulmonary tuberculosis are present. Watson and Cunningham (*Genito-Urinary Diseases,* Phila. & N. Y., 1908, Vol. II, p. 400) by their collected statistics emphasize the importance of establishing the functional capability of the kidney which is to remain after the removal of its fellow. In the first series, which numbers 362, the tests of the functional capability of the other kidney were not made; the operative mortality was 35 per cent. In the second series the tests were employed and the operative mortality was 7.8 per cent.

The presence of active tuberculous lesions elsewhere in the body is not an absolute contra-indication to operation. It must be remembered that if the kidney is not removed the patient will die, and considerable risks are therefore justifiable. Cases must be judged individually. Active lesions often improve after operation. Sometimes a short course of carefully instituted treatment will convert an active lesion into one safely permitting operation. Every case is surgical unless surgery is contra-indicated. In the vast literature which has accumulated regarding the treatment of renal tuberculosis, there are but a few cases in which it is claimed medical treatment alone has effected a cure. Even these are open to doubt. In years past even the most ardent advocate of the non-surgical treatment claimed results in only the early cases and were there no difficulty in definitely discriminating between the very early cases and

the moderately advanced, the fact that nephrectomy is associated with such a small mortality and gives such excellent results in these early cases, is a sufficient reason for urging operation in every case.

The essentials for a satisfactory operation are a long incision, which facilitates the procedure and permits the removal of the kidney without rupture, and the excision of as much of the upper portion of the ureter as can be removed without unduly complicating the operation. It has been found that a tuberculous ureter and bladder will undergo complete resuscitation in nearly all cases after nephrectomy. Some surgeons have recommended complete ureterectomy in conjunction with nephrectomy. The removal of the entire ureter necessitates greatly prolonging the operation, and is inadvisable largely because of the operative difficulties, combined with the fact that practice has amply demonstrated these lesions undergo resolution. It is therefore useless and not worth the additional risk incurred by its performance. The only cases which may require complete ureterectomy are those in which a stricture exists in the lower portion of the ureter, which prevents subsequent drainage. Even this may generally be overcome by dilatation.

Care in not contaminating the wound and absolute hemostasis are essential. An extraperitoneal operation should be performed. Under such circumstances, closure without drainage is the most satisfactory procedure. If doubt exists as to this point, or if the patient is fat, a small wick drain may be inserted and removed in two days. Drainage is a distinct disadvantage in these cases provided a clean operation can be performed. Chronic sinuses are likely to follow drainage, which greatly prolong convalescence. Even if the wound subsequently breaks down after complete closure, the condition is not likely to be much worse than if drainage had been instituted at the time of operation. Wounds have been known to stay open three years, but this is unusual. In the cases of complete breakdown of the wound, secondary suture after the wound has cleaned up offers excellent results.

The severed ends of the ureter should be ligated and cauterized. The injection into the ureter of phenol is unnecessary. The ureteral stump should be cauterized.

In cases which are advanced, or in which the capsule is densely adherent, or in which large pyonephritic lesions are present, subcapsular nephrectomy is extremely valuable and materially facilitates the operation and lessens the danger of hemorrhage. This operation is less satisfactory and more likely to be followed by wound infection than is the standard operation. It is, however, the operation of choice in certain types of cases in which operative difficulties are present that would materially increase the risk of an ordinary nephrectomy. Drainage should be instituted.

Watson and Cunningham (*loc. cit.*) have collected 201 cases of nephrectomy from the reports of Albarran, Krönlein, Israel, Krummel, and Rafin, in which the operative mortality was 5.8 per cent. Modern methods show an operative mortality of not over 1 to 3 per cent in the early cases and 10 to 15 per cent in the late ones. Among the 35 cases of renal tuberculosis operated upon in the Gynecological Service at the University Hospital there has been

no operative mortality from any cause. Regarding the end results, Walker (*Ann. Surg.*, 1907, 14: 249, 388, 597) in a series of 210 patients showed 7 improved, 2 not improved and 15 temporarily improved and the remainder well. In 1912 Israel (*Cor.-Bl. f. schweiz. Aerzte*, Dec. 20, 1912) collected a series of 1023 nephrectomies from the literature. The mortality in the first six months was 13 per cent and as many more died later. About 65 per cent of cures may be expected and about 20 per cent more are improved. The prognosis is said to be somewhat more favorable in women than in men.

The degree of discomfort during convalescence due to vesical irritation is generally in direct ratio to the extent of involvement prior to operation. This tends to improve, but in some instances is a slow process and marked frequency and dysuria may continue for months. Local applications are sometimes valuable. Generally there is a slow but progressive improvement and final clearing up. This course may be interrupted by attacks of ureteral colic simulating calculus, especially in patients in whom there has been marked ureteritis. Tubercle bacillus and pus may continue in the urine for some time.

Nephrotomy may be of value as a palliative measure in cases in which collections of pus are present and in which nephrectomy is contra-indicated. Occasionally nephrotomy may be employed as a preliminary to nephrectomy. Nephrotomy is rarely indicated. Resection of a part of the kidney is inadvisable. A few exceptional cases have been recorded which have been benefited by this operation. The fact that there is no known method by which the condition of the remaining portion of the kidney can be determined, coupled with the knowledge that in the majority of cases it is involved in the tuberculous process, makes this operation generally useless. In the ordinary case nephrectomy not only gives infinitely superior results but is associated with a shorter convalescence and a lesser operative mortality.

The question of operation in the presence of bilateral renal tuberculosis has recently attracted much attention. As a general rule nephrectomy in the presence of bilateral renal tuberculosis is contra-indicated. It is recognized however that renal tuberculosis is often a slowly progressing lesion, and occasionally with what appears an advanced lesion on one side and an early one on the opposite, removal of the more diseased kidney may be a valuable palliative measure, and result in prolongation of life and temporary improvement. In the same type of case, especially if the more diseased kidney is the seat of a large pyonephritic collection, nephrotomy may be advisable.

Postoperative treatment after nephrectomy for renal tuberculosis is of the utmost importance, fresh air, nourishing diet, regular hours of sleep and, in general, the hygiene usually instituted for tuberculous patients, should be employed. It must not be lost sight of that these patients in addition to a long convalescence from a major operation are probably still the incumbents of a tuberculous ureteritis and cystitis, and also have a primary lesion often in the lung and must be treated accordingly. Urine analysis should be performed at regular intervals and the amount of urine passed should be carefully measured. The ingestion of moderately large quantities of water and a bland non-irritating diet is indicated. A warm equable climate is preferable. In the

early and favorable cases in which there is little or no ureteral or vesical involvement, no local treatment is necessary. Frequently, however, in those cases which have suffered from vesical symptoms prior to operation there is a continuation of these, for a time at least, subsequent to operation. At times these symptoms are extremely distressing, and although there is nearly always an ultimate subsidence of the bladder symptoms, they may continue for weeks or even months. Under these circumstances in addition to the administration of large quantities of water and the elimination of irritant foods from the diet, the employment of urinary antiseptics is of value. In severe and long-continued cases vesical irrigation with boric solution often gives relief. For the acute colicky attacks due to the ureter becoming more or less obstructed by pus or detritus nothing equals morphin by hypodermic and indeed it is the only, thing that will give relief. Ureteral fistulæ may develop and are especially likely in cases in which the drainage has been instituted and in which the ureter has been severed flush with the kidney.

Ordinary surgical cleanliness is sufficient in the majority of cases. If the condition persists the end of the ureter may be isolated, if necessary under anesthesia, and a few drops of phenol introduced through a ureteral catheter.

In non-operative cases, palliative treatment consisting of hygiene, diet, etc., should be employed. Local treatment directed to the bladder is rarely productive of results. The injection into the bladder of 2 dr. of a weak novocain solution gives temporary relief. Occasionally, where the bladder is markedly contracted forcible dilatation may effect an improvement. Marked relief sometimes follows the formation of a vesicovaginal fistula when the vesical pains and frequency are unbearable. It is important to make these patients as comfortable as possible. Opium or its derivatives are often indicated and are best administered per rectum or by hypodermic. There is danger of habit forming, but the cases are in any instance doomed and the suffering is often so extremely acute that the exhibition of morphin in large doses is the lesser of two evils. As has been stated, the tendency is to run a slow, progressive downward course with a duration of five to ten years.

TUBERCULOSIS OF THE GENITAL TRACT

Tuberculous Salpingitis.—In cases in which operation is contra-indicated or in which an incomplete operation is necessary, or often as a preoperative measure, the ordinary hygienic and medical treatment usually employed for tuberculous patients may be supplemented by the use of heliotherapy. Bracing fresh air generally at an altitude of 3000 to 5000 feet is valuable. The exposure of the bare skin to the effects of the sun's rays is of prime importance. Allison (*Surg., Gynec. & Obst.*, 1927, 44:743), Gauvain (*Proc. Soc. Med., Lond.*, 1927, 20:1) Dretzka (*Surg., Gynec. & Obst.*, 1128:122) and others have emphasized the value of heliotherapy. This form of treatment possesses many advantages and is often, but by no means uniformly successful. It should be regarded as an adjunct and not as a specific treatment. It is not contra-indicated by fever and indeed is especially beneficial in such cases; generally

the appetite improves, the fever tends to subside and the general condition of the patient improves under the influence of fresh air and sunshine. It is important that apart from the heliotherapy these patients be kept out of doors. The value of sunlight can hardly be overestimated. There is no substitute which produces the same beneficial results. The greatest response is said to be obtained in the spring and early summer.

Properly administered x-ray has proved a valuable adjunct to the treatment of tuberculous salpingitis and peritonitis, but should be given by an experienced roentgenologist. Uter (*Zentrabl. f. Gynäk.*, 1924, 48: 1473) has treated 24 cases by this method without mortality. Cassidy (*J. Obst. & Gynæc. Brit. Emp.*, 1927, 34: 277) treated 17 cases of pelvic and peritoneal tuberculosis by x-ray therapy, 10 were cured, 2 died, 2 improved and 3 remained the same. Toneff (*Gynéc. et obst.*, 1926, 13: 205) reports satisfactory results following the intramuscular injection of colloidal iodin in 4 cases.

Hartius (*Strahlentherapie, Berl. u. Wien*, 1925, 21: 260) states that since the War tuberculous salpingitis has been increasing in Germany. He divides his cases into two groups: Group 1 consisted of 9 cases. These were considered inoperable and were treated by x-ray. Of these 4 were cured, 4 improved and one died six months later from the pulmonary lesion. Group 2 consisted of 19 cases. These were divided into two classes. Groug 2A consisted of 8 cases of which 6 had been recognized before operation and 2, in which tuberculosis was suspected preoperatively. Among these there was one operative death and 3 succumbed later. Group 2B consisted of cases in which the tuberculosis was unsuspected prior to operation. Of these one died two years later of tuberculosis of the intestines, all the remainder were improved or cured. Martius concludes that inoperable cases should be treated with x-ray, high caloric diet, high altitude and tuberculin therapy. Operation should be performed when this treatment fails to produce improvement. Seidamgrotzky (*Arch. f. klin. Chir., Berl.*, 1926, 139: 114) is less enthusiastic regarding the benefits of x-ray. He denies that the x-ray possesses any bactericidal effect upon the tubercle bacilli but attributes the beneficial results to the production of scar tissue. The diet should be nourishing and easily digested, good milk and fresh eggs should be pushed. Whisky in doses of ½ to 1½ oz. once or twice daily, generally in the form of a milk punch, is often beneficial. Lundberg (*Acta Tuberc. Scandin., Copenhagen*, 1925, 1: 179) recommends a diet rich in carbohydrates. Cod-liver oil is often valuable, especially in children. Care must, however, be observed not to cause gastric irritability. Wright (*Canadian M. Ass. J.*, 1925, 15: 828) states that ultra-violet ray is an excellent substitute for heliotherapy when the latter is not available. Provision should be made for as much fresh air as if sun baths were being administered. The extremities should first be exposed to the violet-ray for ten to fifteen minutes three or four times daily, increasing the treatments until a three-hour exposure is attained. This is the maximum duration of exposure. Gauvain (*Brit. J. Tuberc., Lond.*, 1926, 20: 1) recommends short but increasing exposure of artificial light before attempting exposure to actual sunlight, especially in weak and emaciated patients. This authority is

of the opinion that the carbon arc light most nearly resembles sunlight. As already indicated, all of the foregoing methods of treatment are valuable but are by no means substitutes for surgery in such cases in which the latter is indicated. The removal of the intraperitoneal focus of infection is of prime importance and after this has been accomplished the success of hygienic, dietary and medicinal treatment is more likely to be secured. As stated in the original work, all cases should not be submitted to operation, but it is folly to waste time upon palliative means in cases in which large purulent intraperitoneal collections are present which can easily and relatively safely be evacuated. All cases of tuberculous salpingitis and peritonitis are surgical, although operation is not indicated in every case. The hygienic, dietary and medicinal method already indicated are valuable adjuncts and in a proportion of cases are all that should be resorted to.

Tuberculosis of the Genital Tract and Tuberculous Bacillemia.—In 1914, Bacialli reported that he secured uniformly positive blood smears in a series of cases of tuberculosis of the female genitalia. Because of marked difference of these results from those secured by other investigators, Bacialli (*Riv. ital. di ginec.*, 1926, 4: 539) repeated his work in 1924, employing cultural and inoculation methods and found that his later findings were constantly negative. He attributes his former results to technical errors.

Tuberculosis of the Vagina.—In 1925, Wharton (*J. Am. M. Ass.*, 1925, 85, No. 4) collected from the literature 75 cases of tuberculosis of the vagina. In only 39 of these was the diagnosis verified by laboratory methods. Many were autopsy specimens. Tuberculous salpingitis was present in nearly all instances. The prognosis depends largely upon the character of the associated lesions. Excision is the procedure of choice. Conservative treatment is rarely successful. The cases are practically all secondary. Hygienic and medicinal methods are of great importance.

Tuberculosis of the Cervix.—Friedrichs (*Am. J. Obst. & Gynec.*, 1927, 14: 68) adds another case of tuberculosis of the cervix to the already long list. In this case a pulmonary tuberculosis underwent an exacerbation during the puerperium and a more or less general involvement occurred. Both adnexa, body of the uterus, and cervix were invaded.

Tuberculosis of the Uterus and Carcinoma.—Gais (*Arch. Path. & Lab. Med.*, 1926, 1: 542) reviewed the literature upon the simultaneous occurrence of carcinoma and tuberculosis of the uterus and collected 28 cases. In no case was the preoperative diagnosis complete. Operation was generally performed for the tumor. In the original monograph the author has called attention to a form of tuberculous endometritis which superficially, at least, resembles in some respects carcinoma. Tuberculosis may produce apparent reduplication of epithelium, marked irregularity in size and staining properties of the epithelial cells and also simulate new gland formation. Tubercles may be few and in their absence a superficial resemblance to carcinoma is present. All cases of simultaneous carcinoma and tuberculosis should be studied carefully. Such combinations occur but are not common.

Tuberculosis and Pregnancy.—Fruhinsholz and Feuillade (*Bull. Soc.*

d'obst. et de gynéc., 1924, 13:683) states that children of tuberculous mothers may be normal but are often weakly. Almette (*J. Am. M. Ass.*, 1926, 87, No. 24) describes intra-uterine transmission.

The X-Ray as a Means of Producing Abortion.—A number of papers, both from this country and abroad, have recently appeared recommending pelvic irradiation by means of x-ray for the purpose of producing abortion in tuberculous women. In general the results have been good. In the majority of cases the uterus empties itself in ten to forty days, the uterine contents are discharged intact, and there is practically no bleeding. In a proportion of cases the products of conception are discharged piecemeal. Occasionally the abortion has been incomplete and it has been necessary to complete the procedure with a curet, placental forceps or manually. In a few cases abortion has not followed the irradiation and it has been necessary to resort to other means. The chief advantages of this method are that no anesthetic is necessary and the absence of bleeding.

Sterility may result and in some cases this may be an advantage. There are, however, instances in which this would be a distinct drawback to this method. The occurrence of the irradiation menopause must also be considered. When sterility is produced by irradiation the menopause occurs in about the same proportion of cases and in the same severity as develops after a bilateral oöphorectomy, although the former is not always permanent. It is claimed that the pregnancy is checked almost immediately by the action of the x-ray and that even in those cases in which the expulsion of the products of conception is delayed the benefits to the patient are immediate. Further study of this method is required. It is apparently not as certain a method as is the operative procedure, and the delay prior to the expulsion of the uterine contents is somewhat of a disadvantage, as is the effect upon the ovary, especially if further study shows that this is permanent.

Should the x-ray fail to produce abortion the uterus should be emptied by other means as Murphy (*Surg., Gynec. & Obst.*, Aug. 1928) and others have shown that under these circumstances the action of the rays upon the fetus may result in severe developmental defects in the offspring.

GYNECOLOGICAL AND OBSTETRICAL PATHOLOGY

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Much casuistic literature has accumulated since *Gynecological and Obstetrical Pathology* appeared, but this does not require extended mention in this appendix, nor does it warrant a full revision of the text. Two important advances will be referred to in some detail. The first deals with our increase in knowledge of the female sex cycle, the second refers to the entirely new aspect given to the subject of "chocolate cysts" of the ovary by Sampson's researches. Page references mentioned in square brackets will refer to the text of *Gynecological and Obstetrical Pathology.* No continuity could be maintained because of the variety of topics to be dealt with. See also page 451.

Anatomy [page 39].—Latarjet and Rochet (*Gynéc. et obst.*, 1922, 6: 225) describe the pelvic ganglia, some situated on the lateral surfaces of the rectum, others on the sacro-uterine ligaments. Whitehouse and Featherstone (*Brit. M. J.*, 1923, 2: 406) have shown that the circular fibers of the uterus are stimulated by the sympathetic and inhibited by the lumbar cord, the reverse obtaining for the longitudinal fibers. Leveuf and Godard (*Rev. de chir.*, 1923, 61: 219) have studied the lymphatics of the uterus. Their plates are valuable.

[Page 70] A recent publication by Allen (*Am. J. Anat.*, 1923, 31: 439) confirms the findings of Robinson (1918) in the ferret, showing that in the mouse also new "primitive" ova are formed from the germinal epithelium at each sex cycle by a process very analogous to spermatogenesis in the male. If these findings are applicable to all species, the belief that ova are direct descendants from the germ cells of the early embryo must be revised.

Physiology [page 74].—Long and Evans, "The Estrous Cycle in the Rat" (*Mem. Univ. of Cal.*, 1922, Vol. 6), transplanted the ovaries of immature rats into mature castrates. When the grafts took the immature ovaries at once matured and functionated. This observation implies either a restraining influence in the immature subject, or the absence of some necessary factor before puberty.

[Page 82] My own observations and deductions enable me to-day (Frank, *Am. J. Obst. & Gynec.*, 1924, 8: 573) to simplify considerably the analysis of the physiology of the sex cycle. The growing follicle, as I stated in 1922 and before then [page 80], produces the premenstrual, or, using the more striking and adequate phrase, the *pregravid change* in the uterine mucosa.

The mature follicle then ruptures and under proper conditions the ovum is impregnated in the tube. The time of ovulation being variable in the human species, follicle rupture may take place at any time from one to twenty-five days after cessation of the menses. The shell which harbored the ovulum continues the function of the granulosa, quickly changing to the corpus luteum, and maintains and accentuates the decidua in the uterus. The ovum then fixes in the prepared uterine mucous membrane. The placenta, as the corpus luteum becomes inactive, in turn takes up this protective and stimulating power over the uterus and breasts, producing the full hyperplasia necessary to harbor the rapidly growing ovum and to prepare the sex tract for parturition and successful lactation. This unbroken continuous action of follicle, corpus

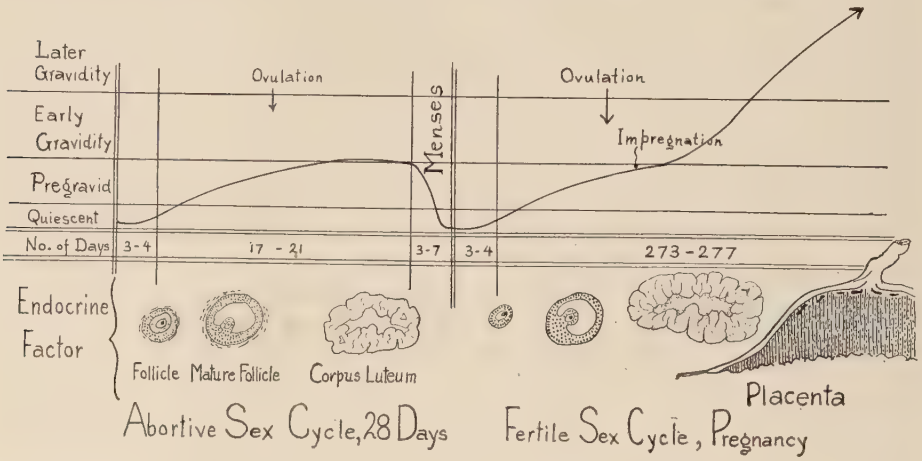

Fig. 1.—Schema of Sex Cycle in Human Female.

To the left is the abortive cycle on which, since all time, attention has been mistakenly focused. To the right is the normal (physiological), fertile cycle, which represents nature's purpose for cyclical variations and its successful conclusion.

luteum, and placenta has induced me to call this important triad *"the gestational gland."*

On the other hand, if the ovum is not impregnated, or if it fails to gain a foothold, the corpus luteum rapidly becomes inactive, the decidually changed mucosa is suddenly deprived of its nutrition, necroses, and is cast off piecemeal (Shroeder, *Monatschr. f. Geburtsh. u. Gynæk.*, 1914, 39: 3; Lindner, *ibid.*, 1922, 57: 119). The raw interior of the hyperemic uterus bleeds, thus producing the external signs of menstruation. In my opinion the older view that *menstruation corresponds to abortion of an unimpregnated ovum is fully justified.*

Almost all of the above changes can be artifically produced. By injecting follicle fluid into immature animals, premature sex development can be obtained (Frank, *J. Am. M. Ass.*, 1922, 78: 181). Injection of follicle fluid or of its lipoid extract, into castrates (Frank, *ibid.*, Allen and Doisy, *J. Am. M. Ass.*, 1923, 81: 819), as well as injection of corpus lutem or of placental lipoid extracts produce the preëstrual as well as estrual changes. (For literature see

Frank, *Am. J. Obst. & Gynec.*, 1924, 8:573, and Frank and Gustavson, *J. Am. M. Ass.*, 1925, 84:1715.)

The breast changes taking place during each sex cycle in the human female have been described by Rosenburg (*Zentralbl. f. Gynäk.*, 1923, 47:111). These constant changes throw some light upon the frequent occurrence of mammary cancer in the female.

Sterility [page 82].—Mechanical interference with conception is now readily diagnosed by means of the Rubin insufflation test. Biological sterility due to a spermotoxin has been described by McCartney (*Am. J. Physiol.*, 1923, 66:404). Reynolds and Macomber (*Fertility and Sterility in Human Marriage*, Saunders, 1924) ascribe importance to the diet, as well as to constitutional factors which lower the level of the threshold of reproduction. In other words, mechanical obstruction is now relegated to the background, while biological causes are emphasized. In my opinion chronic endocervicitis is still the most prolific source of "relative sterility."

FIG. 2.—GRANULOMA INGUINALE IN A NEGRESS

Both labia minora and entrance of vagina involved. Velvety, bright strawberry-red lesions, bleeding readily, secreting a profuse, thin, fetid discharge. Vagina indurated where affected.

Vulva and Vagina [page 107].—*Granuloma inguinale* appears to have existed endemically in the United States for some time but has only recently been recognized. A local papule develops on or near the genitals, breaks down and forms serpiginous, granulating, often nodular or warty lesions of the genitals, perineum, anus, suprapubic or inguinal regions. The fully developed lesions are elevated, bright red, bleed readily and, in the vagina, form doughy indurations. Microscopically warty areas and a non-specific granulomatous tissue are found. Deep scrapings may show capsulate bacteria (Donovan's organisms, calimatobacterium granulomatis, and spirochetes) but their etiological significance is uncertain. Antimony tartrate intravenously is specific. (For literature see Frank, *Southwestern Medicine*, Nov. 1923.)

Vulval and Vaginal Ulcers.—Attempts to classify ulcers of this region have not been specially successful. Teague and Deibert (*J. Urol.*, 1920, 4:543) have grown the organism of chancroid on clotted blood (see also *J. Med. Research*, 1922, 43:61). In erosive vulvitis, Driscoll (*Arch. f. Dermat. u. Syph.*, 1920, 1:170) found a spirochete and vibrio. Aphthous, diphtheritic, dysenteric, and "veneroid" ulcers, the last looking like a mixed syphilitic and soft chancre, but self-limited (see Olson, *Arch. f. Dermat. u. Syph.*, 1920, 1:279) are described.

Under the title of "Ulcus vulvæ acutum," Lipschütz (*Dermatol. Stud.*, Vol. 25. Voss. Leipzig. 1923) has written a monograph covering the subject of

some of these indefinite ulcers. The lesions are not due to venereal causes, show a marked tendency to recurrence over periods of years, and appear in three forms—miliary, "veneroid," or gangrenous. From the ulcer the *Bacillus crassus* can be isolated. This bacillus is identical with the vaginal bacillus (lacticus) of Doederlein. The Doederlein bacillus according to Lipschütz may become pathogenic and is found in urethritis, endocervicitis, and even in salpingitis. The lesion is due to an inflammation of the capillaries and smallest venous radicals and characterized by a lymphocytic exudate into the tissues. My personal impression of this monograph is that it is not convincing.

[Page 148] *Tumors of the rectovaginal septum* are rare. Hermann (*Zentralbl. f. Gynäk.*, 1922, 46: 1862) reported a lymphangiofibroma; Rivett (*Proc. Roy. Soc. Med.*, Sect. Obst. & Gynec., 1923. See *J. Obst. & Gynæc. Brit. Emp.*, 1923, 30: 485) described a calcified mass, while Szamek (*Zentralbl. f. Gynäk.*, 1923, 47: 752) recorded a perivascular spindle-cell sarcoma of this region.

Malpositions, Prolapse [page 165].—Traumatic displacement and prolapse of the uterus is certainly as uncommon as Mock implies (*J. Am. M. Ass.*, 1922, 79: 797). Unless infiltration of the pelvic floor is noted immediately after occurrence of the injury (hemorrhage), no evidence of medico-legal value is available.

Brettauer and Rubin (*Am. J. Obst. & Gynec.*, 1923, 6: 696) have called attention to the fact that uncorrected uterine prolapse in 8 of 10 cases produced dilatation of one or both ureters due to constriction at the site of crossing of the uterine artery.

More and more attention is devoted to the observation that prolapse develops most often in individuals constitutionally handicapped by asthenia and infantilism (von Jaschke, *Arch. f. Gynæk.*, 1923, 120: 56).

Uterus [page 188].—*The cyclical changes* occurring in the uterine mucosa are now universally recognized and are but rarely mistaken for "endometritis." Schroeder and Neuendorff-Viek (*Arch. f. Gynæk.*, 1921, 115: 15) show that acute endometrial infections do not affect the cyclical changes. Prolonged infections (which, I may add, are most unusual) reduce the development of the functional layer, until the final outcome may be the mucosa converted into an abscess lining (inert granulation tissue).

[Page 290] *Papilloma of the cervix*, a rare lesion, was omitted from my book. The accuminate condyloma is seen during pregnancy (usually in gonorrheal infection) and the true wart (not containing nevus cells) is a still rarer finding (R. Meyer, *Arch. f. Gynæk.*, 1921, 115: 167).

[Page 307] Systematic attempts to gauge the degree of malignancy of corporeal cancer by its histology have been made by Mahle (*Surg., Gynec. & Obst.*, 1923, 36: 385). He found that MacCarty's standard of cellular differentiation was an accurate guide in prognosis. Further confirmation is imperatively needed, for though the experience is universal, that "adenoma malignum" is the least malignant variety, it is less certain that the *clinical* degree of malignancy increases step by step with histological undifferentiation.

Fallopian Tube [page 329].—Successful cultivation of the gonococcus by reducing the oxygen tension has been described by Swartz, Shohl, and Davis (*Johns Hopkins Hosp. Bull.*, No. 358, 1920, 31 : 449). Kinsella, Broun, and Garcia (*J. Infect. Dis.*, 1923, 32 : 1) stress the physical factors of the culture-medium. Finally Torrey, Wilson, and Buckell (*ibid.*, 1922, 31 : 148) compare the discordant results of smears, cultures, and complement fixation. Our main reliance will still have to be placed upon the smear. It should be kept in mind that the *Micrococcus catarrhalis* cannot be differentiated from the

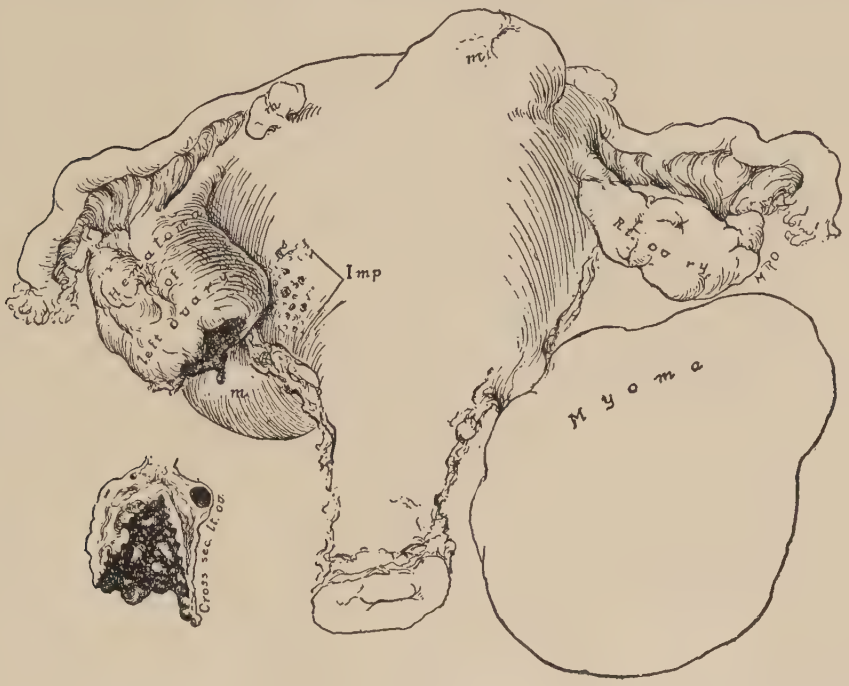

FIG. 3.—HEMATOMA OF ENDOMETRIAL TYPE OF THE LEFT OVARY, WITH PERFORATION

Implantation adenoma (Imp.) on the posterior surface of the uterus near the site of the perforation of the ovarian hematoma, multiple leiomyomasta, early uterine pregnancy with typical decidual reaction of the lining of the ovarian hematoma, and the implantation adenoma of the posterior uterine wall. Posterior view of the specimen removed at operation (x 3/5). (From Sampson, *Am. J. Obst. & Gynec.*, 1922.)

gonococcus by morphological criteria (Shivers, *J. Am. M. Ass.*, 1923, 80 : 1359).

Ovary [page 367].—*Transplantation of the ovaries* has never equaled the glowing expectations first entertained. Martin (*Surg., Gynec. & Obst.*, 1922, 35 : 573) gives a full review of the literature. Autotransplantation offers some hope of success, homo- and hetero-transplants offer none. DeBruyne (*Gynéc. et obst.*, 1922, 6 : 136) in 58 transplants after subtotal hysterectomy saw no signs of follicle ripening. The exception is supplied by Natrass (*Brit. M. J.*, June 23, 1923, 1051) who nine and one-half years after transplantation of both ovaries into the abdominal wall, the menstrual function being preserved,

removed one graft and found normal graafian follicles, a corpus luteum and stroma.

[Page 385] Uterine bleeding often results from torsion of ovarian tumors, even before puberty and after the menopause. Moulonguet-Doléris (*Gynéc. et obst.*, 1924, 9:493) found that in one of every four ovarian growths bleeding occurred after the menopause without torsion of the pedicle. Of 7 uteri examined histologically 5 showed hyperplasia of the endometrium.

[Page 388] "The Life History of Ovarian Hematomas (Hemorrhagic Cysts) of Endometrial (Müllerian) Type," by John A. Sampson (*Am. J. Obst. & Gynec.*, 1922, 4:451) has explained the origin of many hitherto puzzling "chocolate cysts" encountered in the pelvis. In 170 abdominal operations, Sampson found 43 such cysts. According to the author, uterine or tubal epithelium is extruded through the fallopian tube and is implanted in the ovary or on the pelvic peritoneum. The ovary acts as an incubator, small implants forming cysts, which become distended with menstrual blood and rupture, allowing secondary dissemination of the lining epithelium which then may show increased invasive power. Characteristic is the tarry (menstrual blood) content, the early tendency to rupture and to form dense adhesions (irritative peritonitis). If the epithelial lining is destroyed by pressure or by the menstrual reaction (?) the life of the cyst is self-terminated (Fig. 3). Where cellular stroma is encountered about the adenoma tubules Sampson derives the epithelium from the uterus; where cytogenic stroma is lacking he suggests a tubal origin. He considers these implantation adenomata one of the main sources of ovarian cysts and carcinoma.

This paper is of great and fundamental importance. However, until further proof is offered I am still inclined to ascribe the origin of some adenomata to other causes [see page 213]. Moreover, some of the minute "adenomata of the ovary" pictured by Sampson might well be interpreted as atypical follicle atresia. Experimental proof of the transplantability of endometrial tissue in the abdomen of the rabbit was presented by Jacobson (*Arch. Surg.*, 1922, 5:281), clinical proof developed in a case of Lochrane's (*J. Obst. & Gynæc. Brit. Emp.*, 1923, 30:213) in which an adenomyoma developed in the scar, four and one-half years after ventrofixation, increasing with each menstruation.

Obstetrics.—The section in my book which dealt with obstetrics was of necessity much compressed. When a full revision is prepared the subject of "pregnancy and associated lesions," such as the effect of gestation on the special senses, on the circulatory system, on tuberculosis, may well be considered. This applies as well to intercurrent diseases. To-day this would lead us too far afield.

Those interested in the causes of death in pregnancy, labor, and the puerperium can refer to the articles of Katz (*Arch. f. Gynæk.*, 1921, 115:283) and Rosensohn (*Bull. Lying-in Hosp. N. Y.*, 1923, 12:264).

Ovarian pregnancy has been observed so often that even the most skeptical must now be convinced of its occurrence. Convincing cases of primary abdominal pregnancy too have been observed (*Surg., Gynec. & Obst.*, 1921, 32:437,

case II; Jacquin, *Gynéc. et obst.*, 1922, 5:492) the ovum usually embedding near the bottom of the posterior culdesac.

Exception was taken to my statistics on tubal gestation [page 453], my material showing an excess of ruptures over tubal abortion (53:31). Statistics vary widely with the type of gynecological service; Pollack, for example, in 307 cases found ruptured 31, tubal abortion 199, unruptured 39 (*Am. J. Obst. & Gynec.*, 1921, 2:280). Mason and Storrs, on the other hand, reported 167 ruptures and only 75 abortions (*Boston M. & S. J.*, 1923, 189: 914). The tube may resume normal function after the products of conception are removed, as proved by the case of Barrows (see *Am. J. Obst. & Gynec.*, 1921, 2:567), in which only this tube remained and intra-uterine pregnancy took place two years later, and a similar one of Ramsay's (*Proc. Roy. Soc. Med.*, Sect. Obst. & Gynec., 1924, 17:53).

[Page 457] In my book the subject of *premature separation of the normally situated placenta,* also called abruptio placentæ (Holmes) and uteroplacental apoplexy (Couvelaire), was inadvertently omitted. Concealed or external hemorrhage from this cause occurs more often than from placenta prævia (about 1 in 200 pregnancies). Most cases are due to toxemia; a few may result from trauma. In severe cases the uterus resembles a huge ovarian cyst with twisted pedicle. Dark myometric and subperitoneal hemorrhages, most marked near the fundus and over the placental site, hemorrhages in the broad ligament and even in the adnexa, give the uterus a black-red, wet-leather appearance. Fissures through the peritoneal coat, in severe types, account for the intraperitoneal accumulation of blood found. Microscopically an accumulation of fresh blood is found between the muscle-bundles and even between individual muscle-fibers. The changes described in the decidua and uterine blood-vessels are in no way pathognomonic. The placenta may show compression and indentation, if a retroplacental hematoma has formed. The condition is often fatal to the mother because the uterus has lost its contractility and death occurs from intra- and post-partum bleeding. The fetal mortality exceeds 90 per cent. An excellent résumé of the literature is given by Willson (*Surg., Gynec. & Obst.*, 1922, 34:57; see also Scott, *ibid.*, 1924, 38: 450).

[Page 460] I am in full accord with Adair (*Tr. Am. Gynec. Soc.*, 1923, 48:190) who considers that *placental infarcts* are end products ascribable to many and varied causes. Chief among these he places endarteritis, periarteritis and thrombosis, localized hemorrhages due to static, traumatic, or toxic causes. Von Ravenstein (*Zentralbl. f. Gynäk.*, 1923, 47:727) could find no correspondence between infarcts and albuminuria. Talbot (*Surg., Gynec. & Obst.*, 1921, 32:552), without direct evidence, declares that infarcts "are a clinical record of the presence of bacteria in the blood stream of the pregnant woman." If this hypothesis were true, suppurative infarction would be of common occurrence, instead of the aseptic obliteration which is regularly found.

Fetus.—A separate chapter should be devoted to malformations and diseases of the fetus. At present it is not feasible to write this chapter. A few notes may prove of service.

Stratkosch (*Arch. f. Gynæk.*, 1921, 115:408) has written a complete account of acardii.

Strachan (*Brit. M. J.*, 1922, 2:80) describes maceration (non-syphilitic) as autolysis with edema of the interstitial tissue and extrusion of the red blood-cells.

Capon (*J. Obst. & Gynæc. Brit. Emp.*, 1922, 29:239) ascribes general edema of the fetus to obliteration of the intervillous space and polycythemia of the fetus.

Repeated malformations in succeeding pregnancies are discussed by Walther and Lelievre (*Bull. Soc. d'obst. et gynéc. de Par.*, 1923, 12:535), polycystic kidneys and meningocele recurring three times.

Fetal peritonitis is described by Westphal (*Monatschr. f. Geburtsh. u. Gynaek.*, 1924, 66:245).

In these days of "operative midwifery" with version performed for almost any indication, Pierson's "Spinal and Cranial Injuries of the Baby in Breech Delivery" (*Surg., Gynec. & Obst.*, 1923, 37:802) makes wholesome reading. Spinal cord hemorrhages, vertebral fractures, intracranial bleeding were found to be the causes of death.

Roentgen ray injury to the fetus is uncommon. Abels (*Wien. klin. Wchnschr.*, 1924, 37:869) describes the birth of a small male with microcephaly and aplastic penis which he refers to x-raying of the uterus in the second and third month of pregnancy (?).

Eclampsia [page 486].—The statement in the original text that the necrotic areas in eclampsia are usually *central* was an error. The characteristic lesion is located in the *periphery* of the lobule. In spite of much casuistic and experimental work, no new light has been cast upon the causation of eclampsia. The latest detailed work is that of Hinselmann, *Die Eklampsie* (Fr. Cohen, Bonn, 1924).

Internal Secretions [page 499].—Hermaphroditism is really an endocrine disease, due to a bisexual anlage of the gonads. Consequent persistence of part or the whole of the müllerian and wolffian tubular system results. Young reports an interesting case (*Johns Hopkins Hosp. Bull.*, 1924, 35:165) in which the psyche and secondary sex characters were male although the ovary functionated, the testis showing no spermatogenesis. An increasing number of cases like this, of true hermaphroditism, are being reported.

The most important new discovery in endocrinology and also in the entire field of medicine is the isolation of the active extract of the pancreas by Banting, Best, and others. (For original article see *Canad. M. Ass. J.*, 1922, 12:141.)

Insulin has proved a boon, enabling us to control serious diabetes, and rapidly to overcome ketosis. A huge literature dealing with insulin has already accumulated.

Abel has isolated a tartrate of the pituitary extract but has been unable to determine the composition of the active principle.

Researches on the female sex hormone show that the active fraction follows lipoid extractives, that the active principle may be obtained free of phosphorus,

nitrogen or cholesterol (Frank, *Am. J. Obst. & Gynec.*, 1924, 8: 573), and that the vaginal smear method of Long and Evans ("The Estrous Cycle in the Rat," *Mem. Univ. of Cal.*, 1922, Vol. 6) furnishes an easy and reliable qualitative test of potency on the living rat, the animal being available for repeated tests. (Allen and Doisy, *J. Am. M. Ass.*, 1923, 81: 819.)

Most of the enormous literature of endocrinology is so largely clinical that no further discussion is indicated here.

RECENT DEVELOPMENTS IN THIS SUBJECT

In the intervening three years which have elapsed since the last appendix to *Gynecological and Obstetrical Pathology* appeared, numerous interesting development have been published, some of theoretical, others of practical interest. I will again arrange them so as to correlate with the original text.

Physiology [page 68].—P. E. Smith (*Proc. Soc. Exper. Biol. & Med.*, 1926, 24: 131), then working in Berkeley, California, has shown that repeated implants of anterior pituitary lobe produce hypertrophy of the female sex organs in animals. He also showed that such daily implants cause premature sexual maturation in immature rats. Opening up of the previously solid vagina, uterine hyperemia and distention, follicular and corpus luteum formation supervened in the course of five to six days.

Apparently independently, Zondek and Aschheim (*Klin. Wchnschr.*, 1927, 6: 248) have also shown that implantation of human or animal anterior hypophysis into the infantile mouse is followed in eighty to one hundred hours by the onset of estrum.

The production of premature sexual development offers considerable proof that puberty is indirectly brought about by the action of the hypophysis. The reaction may likewise be used as a test to demonstrate the activity of hypophyseal extracts and, in the future, may prove of use in titering extracts derived from the anterior lobe of the pituitary.

Frank and Goldberger (*J. Am. M. Ass.*, 1926, 87: 54; "Clinical Data Obtained with the Female Sex Hormone Blood Test," *J. Am. M. Ass.*, 1928), have shown that the amount of female sex hormone found in the circulating blood varies at different stages of the sex cycle. Immediately after menstruation and up to ten to fifteen days before the next expected menstruation, 50 c.c. of blood give a negative reaction after extraction and injection into the castrated mouse. From five to ten days preceding the menses to the onset of the flow, 40 c.c. of blood give a strong positive reaction in the test mouse. Two to three hours after the onset of menstruation, the hormone can no longer be demonstrated in the circulation, but 5 c.c. of the first menstrual blood shed contain a mouse unit. This cyclical variation of the hormone content of the blood has now been demonstrated in a large number of patients.

In pregnancy, from the seventh to the eighth week on, 40 c.c. of blood contain a demonstrable amount of the hormone. From the eighth week on the hormone level in the circulating blood slowly increases so that toward term,

20 to 30 c.c. of vein blood may contain at least one mouse unit. With the onset of labor the hormone again abruptly disappears from the circulation.

The test has also proved of great importance in evaluating the gravity of amenorrheas. At least two types are found, the one showing a cyclical variation of the hormone amount in the circulation (in these the prognosis is good) and a second type in which no hormone can be demonstrated throughout weeks of observation (this type being less favorably influenced by any treatment).

A similar study of menorrhagia and metrorrhagia frequently demonstrates an excessive amount of hormone present in functional bleedings. Patients in whom severe premenstrual symptoms of nervousness and tension occur usually show a high hormone level in the circulating blood.

The observations of Fels (*Arch. f. Gynæk.*, 1927, No. 4, 130:606) and Margaret G. Smith (*Johns Hopkins Hosp. Bull.*, July, 1927, 41:62) have confirmed the above observations on the presence of a continuous high level of the hormone in the blood of pregnant women.

Loewe (*Deutsch. med. Wchnschr.*, 1926, 52:310) of Dorpat, from his experimental work, concludes that preparations of active female sex hormone extracts have been given in subthreshold or, as he puts it, in "microdoses." He believes that the effective dose in the human female will lie between 100 and 2000 mouse units. In my opinion, at least 250 to 500 rat units will be required, a rat unit equaling 5 to 8 mouse units.

A comprehensive but by no means complete review of the present state of our knowledge in regard to the female sex hormone has been published by Allen and Doisy (*Physiol. Reviews*, Oct. 1927, 7:600).

A. Gengenbach (*Ztschr. f. Geburtsh. u. Gynäk.*, 1926, 89:56) has elaborated the study of Schick on a menotoxin excreted by the human female during menstruation, which was declared as toxic, especially to plant growth. His very elaborate investigation failed in any way to confirm Schick's observations.

J. L. King (Publication No. 363, Carnegie Inst., Washington, p. 79) has taken daily vaginal spreads throughout the cycle in 17 normal women. She concludes that the human vaginal secretion does not serve as an index of uterine and ovarian changes. Evidently the vaginal spread examination, which affords so much information in certain rodents, is not at present applicable to the human species.

K. Dierks (*Arch. f. Gynæk.*, 1927, 130:46) has removed specimens from the vagina of normal women in relation with the cycle and describes a regular growth, with cornification increasing during the premenstrual period. At the time of menstruation a desquamation down to what he calls the basal layer of the epithelium is said to occur. He has not attempted to make vaginal spreads controlling and amplifying his investigation. The changes described in his article are not sufficiently striking to be conclusive, and much further confirmation will be needed before this observation can be accepted.

I. Kross (*Am. J. Obst. & Gynec.*, 1926, 10:64) has shown, by means of parabiosis, that in the rat no labor-inducing substances sufficient to exert an effect on the pregnant partner occur. This is demonstrated by the fact that

when one symbiotic partner goes into labor, the duration of pregnancy in the second partner is unaffected.

M. Murata and K. Adachi (*Ztschr. f. Geburtsh. u. Gynäk.*, 1927, 92:45) have injected early human chorion (second to third month) as well as material obtained from hydatid mole and chorionepithelioma, preserved in ether, intraperitoneally into isolated young rabbits. After a short period of injection, innumerable corpora lutea are found in the ovary of the rabbit. The authors ascribe this effect to the injections. They point out the similarity of their injection results with the lutein cystic degeneration of the ovaries often occurring in patients harboring hydatid mole and chorionepithelioma, and ascribe the changes in both instances to excess stimulation exerted by the fetal ectoderm. From the article I was unable to determine whether they obtained true corpora lutea or merely an acceleration of follicle growth and atresia, because the authors speak of corpus luteum formation in unruptured follicles.

Papanicolaou (*J. Am. M. Ass.*, May 8, 1926, 86:1422) has obtained an extract from the corpus luteum, the mode of preparation of which he does not state with any detail, which, according to this author, inhibits ovulation. He regards this hormone as the direct antagonist of the female sex hormone.

Haberlandt (*Zentralbl. f. Gynäk.*, June 4, 1927, 51:1418) claims to have temporarily sterilized female rabbits by injecting or feeding ovarian and placental preparations. The effect is said to be due to the inhibition of ovulation. These results are as little convincing as those reported by others as due to injection of sperm.

Bodnar and Kamniker (*Ztschr. f. Geburtsh. u. Gynäk.*, 1926, 89:85) are unable by serological methods to determine any sperm immunity in the female.

Rumpf and Smith (*Anat. Rec.*, Aug. 25, 1926, No. 4, 33:291) have shown that in the 9 cm. pig fetus, the thyroid already contains an active substance. The pig embryo must reach a size of 26 cm. before the anterior lobe of the pituitary contains an active extract.

Popow (*München. med. Wchnschr.*, Dec. 11, 1925, 72:2139) has studied the Manoilow sex test with only 11 per cent of failures. The difference in chemical reaction may be due to more active oxidative processes in the male. The test, in my opinion, is not sufficiently reliable to be of practical importance.

Vulva [page 102].—A number of articles dealing with granuloma inguinale have appeared. Cornwall and Peck (*Arch. f. Dermat. u. Syph.*, 1925, 12:613) as well as Goldszieher and Peck (*Arch. Path. & Lab. Med.*, 1926, 1:511) claim to have isolated a bacillus in pure culture from these lesions. They have induced lesions in rabbits from the material obtained from human granuloma and have successfully reinoculated organisms from rabbit to rabbit with the production of lesions identical with those obtained directly from human beings.

Shattuck, Little and Coughlin (*Am. J. Tropical Med.*, 1926, 6:307) advise that antimony thioglycollate cures granuloma with less reaction than any other antimony preparation previously used. The organism isolated by

Peck and his coworkers requires further confirmation before it can be generally accepted as causative.

Vagina [page 136].—W. Liebe (*Ztschr. f. Geburtsh. u. Gynäk.*, 1926, 7: 294) describes a tumor, occurring submucously in the anterior vaginal wall, consisting of hydatid-like masses. The patient was admitted for typical incomplete abortion. The curettings unfortunately were not examined microscopically. Within a few days a mass of bluish tinge was noted in the vagina, bulging out the mucous membrane toward the vaginal lumen. On removal this mass was found to be composed of hydatid-like conglomeration of vesicles which gave the typical morphological picture of hydatid mole. The patient was again curetted, the curettings showing no hydatid mole or syncytial wandering cells but a resting mucosa. For the sake of safety radium was inserted in the uterus. During the short period of observation which has passed, no further recurrences have been noted. It is a great pity that the curettings were not submitted to microscopical scrutiny, as this is a very rare case resembling that of Pick, in which a metastatic villus was found in the vagina, the patient remaining well [see page 470].

Schroeder, Heindrich and Kessler (*Arch. f. Gynæk.*, 1926, 128: 94) have studied the vaginal flora from every aspect. Their work is the most thorough which has come to my attention. In the uncontaminated vagina the *Bacillus acidophilus* grows in intimate symbiosis with the normal vagina. The vagina supplies the substrate which consists of glycogen and albumin. The glycogen is reduced to a monosaccharid and utilized by the bacteria to produce lactic acid. In proper concentration this acid kills off other invading germs. Discharge from above (especially cervical) or massive introduction of bacteria from below, may overcome the protection. In the upper one-third of the vagina the alkaline cervical secretion neutralizes the vaginal acidity. Below this area other bacteria can flourish if the hydrogen ion concentration is not below $P^H 4.6$ ($P^H 5$ being the neutral point). At the vulva, irritations which produce the sensation of moisture are subjectively noted by the patients as "discharge" and may apparently, by reflex influence, cause the exudation of more fluid from the vaginal walls.

H. O. Neumann (*Ztschr. f. Geburtsh. u. Gynäk.*, 1925, 89: 303) investigated the vaginal flora of pregnant women near term. In only 36.5 per cent was an entire absence of contamination (Reinheitsgrade I) encountered. Yet the difference in morbidity noted between these patients and patients in whom the amount of contamination was classified as III, was only 1.5 per cent (namely, 4 per cent *vs.* 5.5 per cent). This would imply that the morbidity is in most instances due to the introduction of bacteria from without.

Schmidt and Kamniker (*Arch. f. Gynæk.*, 1926, 127: 362) consider *Trichimonas vaginalis* as pathogenic. They ascribe the causation of discharge and itching to this parasite.

Wharton (*J. Am. M. Ass.*, 1925, 85: 237) has collected 31 cases of the rare condition of tuberculosis of the vagina to which he adds 2 of his own.

Ottenberg and Gottschalk (*J. Am. M. Ass.*, 1925, 84: 335) emphasize the

possible heredity factor in complete rectal prolapse. They describe one family in which the condition appeared as a mendelian recessive defect.

Uterus [page 210].—Endometriosis and adenomyomatosis has continued to be a live topic. Sampson (*Am. J. Path.*, 1927, 3 : 93) reports dissemination of endometrial tissue in the venous circulation of the uterus through metastatic or embolic causes. At the time of the menses, bits of endometrial tissue intermixed with the menstrual blood escape into the uterine veins through the ruptured endometrial sinuses. Later, by proliferation, these emboli may cause independent endometrial growths at their new location. The final acceptance of this new interpretation is by no means assured.

Seelig (*Am. J. Obst. & Gynec.*, 1926, 11 : 461) has described endometrial adenoma situated in the vermiform appendix. He calls attention to the macroscopic resemblance of these harmless growths to carcinoma.

Novak (*Am. J. Obst. & Gynec.*, 1926, 12 : 484) has taken issue with Sampson's interpretation of the origin of endometrial tissue found in the ovary and on the pelvic peritoneum. In 7 fallopian tubes he was able to demonstrate particles of uterine mucosa lying free within the tubal lumen. In 2 of these cases the ovaries contained endometrial tissue. Of the endometrial fragments found within the tubal lumen, several, according to Novak, were too big to have passed through the minute ostium uterinum. He therefore concludes that the tissue in question originated from the ovaries or from other portion of the celomic epithelium, and that, mainly by tubal ciliary action, these fragments are moved downward from the ostium abdominale toward the uterine ostium. In other words, he believes that the endometrial implants found in the abdomen are formed by a process similar to metaplasia, that they originate from the peritoneal lining, which for unknown reasons again displays the faculty of producing tissues similar to those which it produced in the early embryo at the time that Müller's ducts are formed. This would explain the presence of endometrium-like growths of the ovary arising *in situ* and perhaps later, by mechanical means (movement of intestine, etc.), being torn off and taking root elsewhere in the neighborhood.

The question, as it at present stands, appears to me to allow of three very plausible explanations. Very possibly all three mechanisms may give rise to the growths in question. Cullen's explanation of uterine adenomyomata (which after all cannot be differentiated from the growths described by Sampson and Novak) predicates the penetration of endometrium between the muscle-bundles. Later on this continuity with the uterine lining dissolves, leaving islands of true endometrial tissue within the muscular wall. Proliferation of these islands accounts for both the diffuse mantle of endometrial tissue not infrequently found within the musculature and surrounding the proper uterine cavity, so-called adenomyositis diffusa, as well as the more discrete adenomyomata. Sampson's theory of retrograde expulsion of endometrial fragments through the tubes may account for many instances of diffuse endometriosis found on the pelvic peritoneum and forming the chocolate cysts. Some tumors may just as well be explained by Novak's interpretation, in which the celomic epithelium is said to regain its embryonal capacity of producing müllerian

tissue. His hypothesis should in particular apply to endometriosis on or within the substance of the ovary.

That the female sex hormone plays a great rôle in producing and perpetuating these new growths is unquestioned, because atrophy of this neoplastic tissue occurs when the ovarian function is abolished by oöphorectomy or x-ray and radium castration. The consequence of abolishing the ovarian cycle is twofold, müllerian tissues then no longer undergoing menstruation, as well as an actual involution of these tissues and cells also taking place.

Attempts to correlate endometriosis directly with the formation of carcinoma of the ovary have as yet proved unconvincing.

Fallopian Tube [page 327].—Nothing startling has been added to our knowledge of the pathology of the fallopian tube. Of casuistic interest is the description by Neumann (*Ztschr. f. Geburtsh. u. Gynäk.*, 1925, 89: 211) of the rare condition of teratoma of the tube. He has collected the very scant literature which, together with his case, only totals 14 teratomata of the tube. The description of the specimen shows an enlarged tube, the enlargement being due to a projection jutting freely into the tubal lumen, the mass consisting of fat, débris, hair, sweat and sebaceous glands.

H. Kurtz (*Ztschr. f. Geburtsh. u. Gynäk.*, 1926-7, 90: 133) has added another case of primary tubal carcinoma to the sparse literature, which he brings up to date. In this particular instance many giant-cells were found in the growth.

Ovary [page 366].—Almost all the new literature dealing with the ovary refers to functional and physiological observations and are there described.

Dougal (*J. Obst. & Gynæc. Brit. Emp.*, 1925, 31: 387) has added a case of primary chorio-epithelioma of the ovary in an unmarried woman to the literature referring to this unusual and almost invariably fatal lesion. The growths appear as blue-black, friable, hemorrhagic enlargements of the gonad, with early involvement of the surrounding tissue. Differentiation from ovarian pregnancy is difficult.

Black (*Am. J. Obst. & Gynec.*, Sept. 1925, 10: 345) reports 2 cases of solid teratoma of the ovary, the one patient remaining well after three years, the other after fourteen months of postoperative observation. These are exceptionally good results in this very fatal type of tumor. The last statistics were those collected by Frankel (1920), containing only 60 cases from the world's literature.

Pelvic Connective Tissue [page 439].—A. Gough (*J. Obst. & Gynæc. Brit. Emp.*, 1927, 34: 530) reports a huge pseudofluctuating tumor arising from the left side of the pelvis and growing through the abdominal wall. Immense subcutaneous lumps resulted in the left iliac fossa and invaded the left labium where an enormous pendulous mass developed. The left buttock likewise was bulged out by a mass growing posteriorly from within the pelvis. He removed the extrapelvic portions of the tumor both anteriorly and posteriorly, obtaining over 10 pounds of tissue, described as typically myxomatous. He considered the intrapelvic growth inoperable. Not only is this condition rare, but the direction of extension taken by the growth is unusual.

Obstetrics [page 445].—Hofbauer (*Johns Hopkins Hosp. Bull.*, 1926, 38: 255) has called attention to the fact that the bases of the broad ligaments during pregnancy acquire a strong phagocytic power due to the development of new phagocytic tissue. This tissue in the vaginocervical region confers an increased local immunity which helps to protect against invasion of bacteria so frequent before, during, and after labor.

This same author, together with Geiling (*Johns Hopkins Hosp. Bull.*, 1926, 38: 143), has reproduced to a striking degree the picture of abruptio placentæ by means of histamin poisoning induced in guinea-pigs and in carnivora. Hofbauer therefore concludes that histamin or allied bodies may account for this serious complication of gravidity. However, Browne (*Edinb. M. J.*, Oct. 1926, p. 151) has been able to cause the same lesions by means of oxalate nephritis. Therefore, it seems to me that all that we can deduct from these experiments is that various poisons elaborated during pregnancy may bring about the premature separation of the normally situated placenta with its concomitant lesions, and not that histamin must be the offending substance.

Rucker (*Am. J. Obst. & Gynec.*, 1926, 11: 189) has described a case of considerable casuistic interest in which the placenta at term was born fifty minutes before the expulsion of the freshly dead fetus.

Findley's (*Am. J. Obst. & Gynec.*, 1926, 12: 318) compilation of 132 cases of uterus didelphis, among which numerous cases of pseudodidelphic uterus are included, in addition to 3 cases of his own, is of interest. He emphasizes the unusual degree of fertility accompanying this malformation, which doubtless can be accounted for on a purely phylogenetic ground, as this type of double uterine canal is normal among the more fertile lower species.

Emil Novak (*Surg., Gynec. & Obst.*, July, 1926, 43: 26) has compiled 276 cases of coincident intra- and extra-uterine pregnancy. Of this number 32 have been noted since 1913. This type of twinning is of interest to both the pathologist and clinician.

Hirszfeld and Zborowski (*Compt. rend. Soc. de biol.*, Jan. 29, 1926, 94: 205) report that infants with the same blood-grouping as the mothers averaged 300 Gm. heavier than infants in whom the blood-grouping differed from that of the female parent.

C. Thomson (*J. Obst. & Gynæc. Brit. Emp.*, 1927, 34: 40) has made a careful study of maceration occuring in fetuses dying *in utero*. Twenty-seven specimens were examined. This article does not lend itself to abstraction, but is well worth referring to when it becomes necessary to determine the time elapsing between expulsion and antecedent fetal death.

Internal Secretions [page 502].—Much progress has been made in the titration of the female sex hormone by means of the vaginal smear test of rodents, which is now generally employed. Concentrated preparations of these extracts, whether obtained from the ovary or from the placenta, unfortunately, all undergo rapid deterioration on preservation. This has proved an as yet insurmountable obstacle to their clinical use.

Laqueur and his collaborators as well as Zondeck (*Klin. Wchnschr.*, 1925, No. 21, 1926, No. 27) and others have obtained water-soluble preparations.

No noteworthy advance in the chemical purification and isolation of the hormone is to be noted.

The variation in concentration of the female sex hormone in the circulating blood found in various functional diseases of the female genital tract by Frank and Goldberger has been referred to under physiology. By means of this method of investigation considerable light has been shed upon obscure conditions such as amenorrhea, menorrhagia and metrorrhagia, and the effect of obesity on the genital sphere.

Keatinge (*J. Obst. & Gynæc. Brit. Emp.*, 1926, 33:653) has reported 2 cases of precocious puberty. The first patient began to menstruate at the age of 6½ years and showed fully developed female secondary characters. The removal of an ovarian dermoid was followed by cessation of menstruation and the return to infantile conditions.

The second patient had been found to menstruate since the age of one month, at the time of observation being 3½ years old. Laparotomy revealed maturing ovarian follicles, especially in one ovary. This ovary was resected without in any way influencing the prematurity, as could have been anticipated by the fact that no tumor was present. Therefore the stimulation must be ascribed to the influence of some other endocrine factor.

Through a personal communication of L. A. Crowell, who in June, 1921 (*South. M. & S. J.*), reported a colored child in whom premature sexual maturity had developed, I can now add that the symptoms were relieved by the removal of a large ovarian cyst. After a period of several years had elapsed during which complete return to the infantile stage had continued, menstruation at the normal age of puberty was resumed.

C. H. Davis (*J. Am. M. Ass.*, 1926, 87:1004) has investigated the thyroid hypertrophy occurring during pregnancy in 520 women. In 41 per cent a visible hypertrophy could be noted early in pregnancy. All symptoms were relieved by small doses of iodin. As a rule these patients all showed an increase of their basal metabolism while the hypertrophy continued. His observations were made in a goiter district and therefore do not apply to the same degree in other regions.

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DISEASES OF THE VULVA

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Anatomical Variations of Bartholin's Gland.—There exists considerable variation in the location and size of the glandular structures about the vulva. These consist primarily of four types of glands: (1) The sebaceous glands situated in the mons veneris, the labia majora and minora and the genitocrural fold, that secrete a white, claylike, odorous material; (2) sweat-glands, found in about the same area, giving to the vulva its glistening appearance; (3) mucous glands situated around the clitoris, to either side of the urethra (corresponding to the prostate gland in the male), and around the insertion of the hymen; many of them having a duct that can be probed; and (4) the large vestibular glands, so-called Bartholin's glands. Melnikoff [1] has recently made a detailed study of the variations in conformation and location of Bartholin's glands. They are first visible in sections of the embryo at the tenth or eleventh week and develop slowly until puberty when they become definitely palpable structures about 1 cm. in diameter. Even in the same individual they may vary considerably in size. In general the greatest diameter is 1.5 to 2 cm. It is often impossible to determine by the size alone the presence of an infection. The gland itself in over half the cases lies somewhat below the line of the posterior commissure. In the remaining 40 per cent it lies to the side of the vaginal outlet. On the other hand the opening of the duct is situated somewhat higher, and in cases of perineal laceration there may be a dislocation of the meatus of the gland so that it is nearer the urethra than the perineal fold. Of special interest are the reduplications of this duct, occasionally leading to a double meatus on one or both sides.

Treatment of Bartholinitis.—The unsatisfactory results in the treatment of infections of Bartholin's gland, especially those due to gonorrhea, have led to several new therapeutic suggestions. Huebner [2] injects the patient's own blood in the periphery of the gland and in all 10 cases reported obtained a complete cure of the infection. In 3 instances the injections were repeated. Sieber [3] had a surprisingly satisfactory result with x-ray in an acute gonorrheal infection of this gland. He employed a 3 Mm. aluminum filter, a field 6×8 cm. in size and 80 per cent H.E.D. as a dose. This treatment was repeated on four successive days. Already on the third day gonococci were absent in the secretions. One month later after an injection of 0.5 Gm. arthi-

gon as an excitant, a few gonococci could again be found in the duct of the gland. Now a final treatment with 0.5 Mm. zinc as a filter, 1 H.E.D., was given with permanent result. He suggests a further trial of this therapeutic measure.

Vulvovaginitis in Children.—Kahn [4] on the basis of 207 cases distinguishes two forms, one a simple catarrhal form, due to chemical, thermic, or mechanical irritation, and the other a bacterial form. In the bacterial group we must differentiate those due to gonorrhea from those due to other bacteria. The latter he terms "pseudogonococcic vulvovaginitis." In the gonorrheal form he finds an autogenous vaccine of value. If this is not available, a polyvalent diplococcus vaccine is recommended. Other treatment consists of salves or irrigations with silver albuminate preparations and, above all, increasing the resistance by strengthening the body.

Anatomy and Physiology of the Clitoris.—Heyn [5] gives the measurements of the clitoris as ranging between 0.5 to 5.0 cm. in length, 2 to 15 Mm. in thickness and 5 to 7.5 Mm. in transverse diameter. Among older writers the statement is often found that in tropical countries, and especially among the black races, the clitoris is larger than among the white. There is no real evidence supporting this. This impression probably originated from the fact that the labia majora are smaller in the blacks, thus leading to increased prominence of the labia minora and clitoris but without actual increase in size. There is also no evidence showing that the increased size of the clitoris is the result of increased sexual activity. Out of 1000 women he found a large clitoris (4 cm. or more) in 1.6 per cent only, whereas 33.7 per cent of these women evinced a greater amount of sexual activity. It would seem that the size is more the result of congenital formation than hypertrophy. Where a large clitoris is present, however, there is usually excessive sexual irritability.

That the clitoris is an essential factor in the production of the orgasm in women and so is a factor also in sterility, has been definitely disproved. Out of 529 women the vagina was found to be the important factor in orgasm in 362 or 68.4 per cent, whereas the clitoris was the sensitive spot in only 159 or 30 per cent of these cases. Of the latter group only 23.2 per cent reached the state of orgasm constantly, whereas in the group with vaginal sensibility the percentage of regular orgasm was 40 per cent. It is therefore untrue that a small clitoris is in any degree a factor in sterility or lack of sexual excitement.

Variations in the Morphology of the External Genitals.—While in general there is a wide range in the normal aspect of the external genitals slight abnormalities may serve as a valuable index of the sexual development of the patient. The vulva is one of the most important of the secondary sex characters. It represents fairly accurately a mirror of ovarian function. The extent and distribution of hair growth, according to Labhardt,[6] indicate often a more masculine type with growth over the entire thighs, associated ofttimes with scanty menstruation. Mention has already been made of variations in the size of Bartholin's gland and the clitoris. The perineum also varies greatly both as to its height and as to the presence or absence of a special frenulum.

Occasionally an ovarian tumor is associated with a hyperdevelopment of the vulva and this same condition has also been noted in tumors of other ductless glands, as in Babcock's case of hypernephroma.

Unusual Tumors of the Labia.—Ferguson [7] describes a pendulous tumor of the left labium majus, which developed after a fall and was at first diagnosed as an unusual variety of levator hernia. An exploratory laparotomy showed no connection with the upper pelvic organs and a short time later the tumor was itself removed. It was found to be elongated and in close relationship to the rectum extending forward under the symphysis. The tumor mass measured over 2 feet in length after removal and microscopic examination showed a telangiectatic fibromyoma with hyaline degeneration and edema. The patient made a good recovery from the operation.

Kardschieff [8] describes a somewhat similar tumor which he calls a fibrotelangioma of the labium majus. He believes the point of origin in his case to have been the corpora cavernosa of the labia majora.

Cystic tumors of the labia minora, according to Mondor and Huet,[9] usually contain a viscid, colorless fluid. Cholesterin crystals are often found. These authors favor the theory of an origin from wolffian remnants. Thirty-eight cases in literature are reviewed. Bonaretti [10] has also recently described a double cyst of the labia minora, whose origin he attributes to remnants of the müllerian ducts. Both cysts were the size of a hazelnut. In view of the absence of any embryological relation between the vulva and the wolffian or müllerian ducts, it seems impossible that they have any real etiologic significance. What has been said at the beginning of this chapter about glands normally found about the labia and vestibulum offers a more plausible explanation of the point of origin of these cysts.

Treatment of Pruritus Vulvæ.—Results of x-ray therapy in pruritus of the vulva vary considerably. Siegfried Meyer [11] finds that with suitable dosage 60 per cent out of 46 cases were fully cured, and all were partly relieved. In case of recurrence of the pruritus a second course of x-ray treatment will usually give the desired result. On the other hand, Werner [12] failed to get any improvement in half of the 51 cases of his series. In view of the association of the pruritus with ovarian disturbances he is inclined to attribute the favorable results rather to distant action on the ovaries than to a local effect on the vulval nerve-endings. He therefore favors direct raying of the ovaries together with the administration of ovarian extract. In this connection it is of interest to observe that good results have been obtained by Langhans [13] with psychotherapy in the form of hypnosis in cases of pruritus associated with kraurosis.

Relation of Vulval Diseases to Fertility, Pregnancy and Labor.—In the section on diseases of the vulva of Halban-Seitz's handbook on *Biologie und Pathologie des Weibes,* Volume III, A. Labhardt gives a good review of the relation of fertility and childbirth to these diseases.

Fertility can be hindered by conditions producing a mechanical obstruction such as an imperforate or rigid hymen. At times this structure is so thick and fleshy that it requires incision and even excision to permit of sexual rela-

tions. The fact that occasionally pregnancy will occur with an intact hymen is, however, evidence that it is not always necessary for the immission of semen to take place within the vagina. That large tumors of the labia or extensive cases of chronic hypertrophies of the vulva will prevent sexual relations is self-evident. A not infrequent hindrance follows operations for perineal repair that leave a small vaginal opening with a firm unyielding scar-tissue ring at the introitus. Occasionally the sclerosis following kraurosis of the vulva or the scars associated with extensive vulval ulcerations will prevent coitus and so produce sterility. In addition to these mechanical obstructions, we have also to consider certain inflammatory conditions that make sexual relations impossible and so lead to sterility. These inflammations are usually chronic and associated with severe pain when they are touched. The most common of these conditions are caruncles of the urethra, and the condition known as vaginismus, or vaginal spasm, hindering coitus, often results.

Pregnancy produces many changes about the vulva owing to the obstruction of the venous and lymphatic return. Varicose veins may develop of such size as to require a compression bandage for their relief. Edema is at times present, especially in the presence of heart or kidney complications. Condyloma acuminata are prone to appear in the presence of an acute gonorrhea and develop to considerable size by the conclusion of the pregnancy. In the puerperium these condylomata usually disappear spontaneously. Mycotic vulvitis is not rare during pregnancy associated with a similar infection of the vagina. Herpes of the vulva has also been observed. In the presence of a furunculosis during pregnancy it is very important to eliminate the infection as rapidly as possible since it may prove a complicating factor at the time of labor in predisposing to puerperal infection. Vulval tumors, such as carcinoma or sarcoma, are rarely found in women during the childbearing years.

Labor is only rarely complicated by diseases of the vulva. Large vulval tumors, especially if associated with sclerosis or scars about the introitus, may prove a hindrance. Yet in the case of the large pendulous tumor described in my monograph, page 111, there was no difficulty in either of the two deliveries occurring after its development. Furunculosis, vulvitis, and Bartholin abscess are more serious complications owing to the danger of infection. Labhardt tells of two patients who lost their lives from puerperal sepsis resulting from furunculosis of the vulva. Hence he advises applications of tincture of iodin to the vulva before and after delivery in such cases. Varicosities of the vulva require special care to prevent rupture of a large vein during labor with resulting hematoma of the vulva.

Acute Ulcer of the Vulva.—The disease first described by Lipschuetz and Scherber as "acute ulcer of the vulva" due to infection with the *Bacillus crassus,* is beginning to be recognized by observers in other countries beside Austria. It was first described by Lipschuetz in 1904 as a pseudovenereal ulcer. Gradually the definite relationship between these ulcers and the *Bacillus crassus* or *Bacillus vaginalis* of Doederlein, a saprophytic organism commonly found in normal vaginas, was definitely established. For many years, however, the disease seemed strangely limited to Austria and Germany. In 1923, I had

occasion to record the first case of this disease published in this country and reported it with photographs (pp. 51-56) in my monograph on *Diseases of the Vulva* in this series. American dermatologists (Finnerud, Rostenberg and Stryker), who have recently become interested in this disease, were unfamiliar with my publication.

Rostenberg[14] and Stryker[15] merely give brief case reports, but Finnerud[16] goes more carefully into the pathology and literature. He describes a case seen by him in the clinic of Riehl in Vienna, and analyzes a total of 56 cases reported thus far. In general, there would seem to be two types:

1. Gangrenous type, marked by temperature with the sudden development of a few large round ulcers covered by a membranous exudate that is cast off and heals in from one to two weeks.

2. Venereal type, having slight or no constitutional symptoms, with many small irregular ulcers resembling chancroids, running a more chronic course.

The initial lesion seems to be an ulcer or soft inflammatory nodule appearing in the labia minora and vestibulum. Both Finnerud's case and the one described by me belong to the gangrenous type.

In English literature we have an interesting report by McDonagh,[17] who has in the past ten years observed 5 cases of acute ulcer due to *Bacillus crassus* infection. In contrast to this he also describes 6 cases of acute ulcer due to Vincent's infection, a symbiosis of *Spirochæta refringens* and fusiform bacilli, but the clinical picture of this condition seems far from clear and the suspicion is given that these lesions are primarily syphilitic, particularly as they disappear after treatment with salvarsan. Monacelli's[18] report of 3 cases of acute ulcer of the vulva is the first in French literature. Microscopically he found vessels resembling a periarteritis nodosa. Delbanco,[19] of Hamburg, gives a convincing description of an acute ulcer of the vulva in a 13-year-old girl.

The reports all emphasize the relative frequency of this disease among virgins. In Finnerud's analysis, 70 per cent were found in virgins, and the remainder in married women. Characteristic of the disease is the rapidity with which the lesions heal under simple mild antiseptic washes, and their tendency to recurrence in crops. The persistent application of aluminum acetate packs to the vulva daily for a month will usually give permanent relief.

Edema of the Vulva in Pregnancy.—The importance of pronounced edema of the vulva associated either with varicose veins of the vulva and the pelvic organs or with toxemia of pregnancy has been emphasized in recent reports. In a certain number of these cases the edema did not subside under rest and medication and produced such complicated conditions for delivery that cesarean section became necessary. In the reports cited above, there were 5 cases in which cesarean section was done for this indication.

Hoehne[20] describes 5 cases in all. He performed a cesarean section in one complicated by preëclamptic toxemia. In another patient he made an incision over the external inguinal opening through the skin to allow drainage of the fluid in the tissues. This patient was thirty-nine weeks pregnant. After

drainage there was no return of the edema and delivery was normal. Hoehne considers it dangerous to make an incision over the vulva on account of the possibility of an erysipelatous infection, hence he prefers the suprapubic cut. Gertler [21] speaks of the danger in edema of the vulva of a break in the vulva skin with antepartum infection: hence he prefers section to delivery through the normal channels. Greenhill [22] did a section in a case of marked edema due to toxemia. In Skutsch's [23] patient the vulva was already somewhat gangrenous at the time of delivery, and cesarean section seemed imperative.

Weissenberg [24] is more conservative. He considers operative measures dangerous in these women, and in 2 cases with marked edema of the vulva secured complete relief with spontaneous normal delivery by making multiple punctures with the cautery point, permitting the escape of fluid from the tissues. This escape of fluid was accomplished within fifteen minutes.

Angioneurotic edema of the vulva in pregnant women was observed by Joachimovitz.[25] In one patient, contact with hay-fever pollen, to which that individual was sensitive, produced a marked edema of the vulva when the pollen was applied at this point. He also describes a case in which edema of both labia and clitoris appeared at intervals of about three weeks as a menstrual reaction for some period of time. When this patient became pregnant, a similar reaction of temporary vulval edema of three to four days duration occurred at the same interval of time. No treatment was given in this case as the symptoms were transitory and not severe.

Chronic Hypertrophic Vulvitis (Esthiomene, Elephantiasis, Ulcus Rodens Vulvæ, Syphiloma).—There is a striking similarity in all but the names applied to them in the chronic ulcerative processes about the vulva attended by nodular hypertrophy. The Germans prefer to speak of "ulcus rodens vulvæ"; the French term it "esthiomene"; the English call it "elephantiasis"; and here in America the name of "syphiloma" has been coined. Although there are differences in degree depending upon whether the ulceration or the hypertrophy predominates the pictures, it is in my opinion utterly hopeless to group these conditions other than as I did in 1923 as "chronic hypertrophic vulvitis."

In the past four years efforts have been made by some to emphasize syphilis as the etiologic factor; by others, to attach greater importance to tuberculosis as the cause.

Stein [26] has made an additional observation in which the vulval tumor was shown to be due to syphilis. Very full gross and microscopic descriptions and complete autopsy findings are presented in evidence of his contention. The vulval lesions were accompanied by gummata of the rectum. Jirasek [27] describes 2 cases with an anamnesis that spoke for syphilis but with Wassermann test negative and spirochete not present. A few giant-cells were noted, marked endarteritis and other characteristics of a luetic infection. Medina [28] reports 4 cases, all showing a positive Wassermann reaction; 2 associated with gonococci and one with tubercle bacilli. X-ray was applied without result. Surgery cured one case and Medina thinks that with early diagnosis, surgery is the only satisfactory therapeutic agent.

Beck's[29] case had negative Wassermann reactions, and marked lymphocytic infiltration. He thinks the condition due to inflammatory processes imbedded in tissues whose lymph channels have become blocked. Similar views are held by Schoenholz.[30]

In 1900 Rieck had demonstrated the association of tuberculosis with this type of vulval lesion. In 1927,[31] he again takes up the cudgels in defense of his theory that tuberculosis is the usual etiologic factor. In 8 cases, including his own, the histologic evidence pointed to tuberculosis. He was able to demonstrate tubercle bacilli in the tissues of the ulcer in his own case. Rieck goes to the extreme of maintaining that no other factor beside tuberculosis has ever been conclusively proved, and almost in the same breath declares that even in the absence of bacilli, a negative tuberculin reaction, negative animal inoculations and histologic findings, we cannot say that tuberculosis was not responsible for the disease. In accordance with this theory, Rieck considers operative measures only rarely indicated. These should be limited to minor corrections of fistulas or pockets. He makes applications of tincture of iodin to the ulcers every other day for a month. Sunlight is also of great value in healing these ulcers. Heyneman[32] reports a cure from sunlight treatment alone. He agrees with Rieck in his findings and believes that persistent search will usually reveal evidence of tuberculosis.

The writer has seen several cases of this disease since the publication of his monograph and from his study of them is convinced that the underlying factor is rather nutritional than due to any specific microörganism. Syphilis is apparently the most common cause of the blocking of lymph- and blood-vessels in these patients, but the infectious agent producing the ulcers may be any of a myriad that are found about the vulva. There is no question that the irritation associated with lack of cleanliness is an important factor in contributing to the hypertrophy and ulceration in these women.

Melanoma of the Vulva.—While in my original monograph I stated that melanoma was rarer than sarcoma, a more careful review of recent literature would indicate that a majority of the tumors classified as sarcoma or pigmented sarcoma were really melanomata and that the vulva is really an important site for the origin of these pigmented tumors. Besides the 6 cases reported in the articles that are cited above, I saw this year an unusually early case of melanoma complicating pregnancy. The patient, a Jewess, was a decided brunette, 29 years of age, who was in my care for her first pregnancy. A pigmented mole situated over the mons veneris about 1½ cm. in diameter, doubled in size during the last month of her pregnancy. At the time of her delivery, April 2, 1927, it was decided to remove the mole. Since there seemed no reason to suspect a malignant change except a slight increase in size, the excision of the mole was made close to the pedicle. The microscopic report came back that it was a melanoma. Hence, three days later a radium application was made over an area 6 cm. to all sides of the site of the growth. The total dosage was 1600 Mg.-hours. It was felt that as much could be accomplished by such a radium application as by a secondary operative procedure. By so doing, the mental and physical strain upon the young, recently confined mother was

greatly reduced. It is now almost a year since the removal without evidence of recurrence.

Almost without exception, the cases reported have ended fatally. Of the 3 cases reported by Goforth [33] from the University of Pennsylvania clinic, 2 had multiple nodules and ended fatally. One showed a nodule the size of a lemon, and was still well seven and one-half years after operation. All three tumors were primarily on the labium majus. Goforth concludes that all vulval pigmented nevi should be regarded as potentially malignant and should be treated by excision with a wide margin of apparently healthy tissue in all directions. In case of evidence of unusual behavior or definite malignant change, removal of the regional lymphatic area in addition to the local excision is advised by Goforth. Frequent reëxaminations to detect recurrences early in their development is urged to improve results of the treatment. Labhardt [34] emphasizes the bad influence of pregnancy upon these pigmented moles. In 50 per cent of melanoma, the malignant change occurred in the course of a pregnancy. Sahler's [35] patient was 28 years old. She had multiple metastases that followed two years after the removal of what was thought to be a simple nevus. Death occurred soon thereafter.

Pruritus, followed by the development of a knot in the left labium majus, was recorded in Gatter's [36] case, a woman of marked dark brown coloring of skin and hair. Subsequent to its operative removal, metastases in lung, liver and lymphatic system occurred. Garbien [37] cites Kaposi, Bernard and others as having found these pigmented tumors almost wholly among Jews. In his case, there were multiple symmetrically arranged pigmented nevi about the pubic region of the vulva and the inner aspect of the thighs. They disappeared after x-ray treatment but reappeared fifteen months later as dark blue spots over the entire vulva and histologically were malignant. He calls them sarcomata but this classification, in the light of our present knowledge, does not seem justified.

Other Neoplasms of the Vulva.—Hoeck [38] describes a broad-based polypoid tumor situated on the left labium majus, that proved to be a hidradenoma or sweat-gland tumor, of tubular type. It showed no evidence of malignant change on microscopic section and two years after operative removal, there was no recurrence.

An unusual tumor of the vulva is described by Bartcky.[39] It had all the histologic characteristics of an adenofibroma of the breast and Bartcky is of the opinion that the tumor originated from misplaced mammary gland tissue in the vulva.

The malignancy of vulval carcinoma and an unusual form of extension, is illustrated in Crisholm's [40] case. Six months after operation, there occurred multiple subcutaneous metastases over the entire body. Death occurred within a very short time. Seidemann [41] reports 8 cases of carcinoma of the vulva operated on in the past ten years with 4 remaining free of recurrence for more than five years.

A pendulous fibroma of the clitoris, 7 by 10 cm. in diameter, in a 70-year-old woman, is described by Ottow.[42] There was a history of rapid growth in

the ten months previous to operation. The mass was found to be composed of two entirely separate fibroid tumors, originating from the preputial skin rather than from the clitoris itself.

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NON-OPERATIVE TREATMENT IN GYNECOLOGY

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In the short time which has elapsed since this monograph first appeared, no important changes or additions have occurred which would render an extensive revision of the text necessary. A surprisingly large number of letters from almost all parts of the country has demonstrated to me the vivid interest of physicians in the subject presented and the satisfactory results obtained with many of the procedures recommended by me. Particularly numerous have been the inquiries regarding the powder treatment of leukorrhea which clearly indicates that the traditional therapy with douches and curet has proved unsuccessful.

For this reason a brief résumé of the proper treatment of leukorrhea appears desirable.

Leukorrhea.—Leukorrhea or, as it is commonly called, vaginal discharge, originates in the vagina itself in only an insignificant number of cases. In the great majority of instances it derives its origin from the cervical canal; less often does it come from the uterine cavity.

The vaginal discharge proper is thin and foamy, and yellow in color if caused by the *Trichomonas vaginalis*, or somewhat thicker in consistence and slightly offensive in odor if saprophytic or other bacteria have been the cause; neglected pessaries or other foreign bodies introduced for contraceptive or masturbation purposes may give rise to a purulent and foul secretion.

The cervical discharge is always thick, grayish in color if purely mucous, but more often with a yellowish tint due to the action of pus-forming microbes; in the earlier stages of gonorrhea it takes on a greenish hue.

The endometrial discharge, finally, is a thin, grayish, yellowish, or colorless fluid. It may represent a hypersecretion of the uterine mucosa due either to endocrine disturbances or to chronic, non-infectious congestions (fibroids, retrodisplacements, subinvolution, etc.), or it may be the end result of a uterine infection of long standing.

With such a variety of causes, sites of origin, and physical properties it is obviously illogical to expect results in every case from one and the same remedy. To institute one's treatment in so injudicious a manner is apt to bring a meritorious method into discredit. The first step of a successful treatment must, therefore, be a correct diagnosis, and this requires inspection

through a speculum. It is high time that the traditional administration of vaginal douches be curtailed. Very little can be said in favor of them, as I have stated more in detail on page 317 of the original monograph. There is an occasional indication in purely vaginal discharge, but in cervical or corporeal leukorrhea the douche can accomplish nothing. Yet, it is no rarity to hear from patients that such douches had been prescribed for them four or more times a day!

The vaginitis due to trichomonas requires a specific treatment as described on page 211. The discharge of senile vaginitis will yield to the measures presented on page 168.

The sovereign remedy both for vaginal and cervical discharges is the powder treatment inaugurated by Nassauer. This method is fully discussed on page 349. Its efficacy may be gauged by the numerous imitations and modifications it has brought forth in recent years. I merely repeat here my recommendation to use equal parts of kaolin and bicarbonate of soda for the insufflations which are made every two or three days.

In obstinate cervical discharges, and particularly in cases where everted and eroded cervical lips keep up the irritation of the cervical mucosa, the powder treatment should be combined with electrocauterization according to the method of Dickinson, which has been described fully on page 287. Since employing this combination of methods, I have been able to reduce the number of amputations of the cervix to a very large extent. The endlessly repeated cauterization of the cervix with tincture of iodin or silver nitrate, which was a favorite method with the older generation of practitioners, is now definitely obsolete. One wonders whether the endurance of the patient was more to be admired or that of the physician!

Discharge from the endometrium itself presents an entirely different problem to the therapeutist. Each case demands individual study and treatment. The leukorrhea of young girls needs no local treatment but will yield to a general hygiene enforced, perhaps, by some iron and arsenic. In endocrine disturbances the corresponding organotherapeutic remedies, empirical and incomplete though they are, must be employed. Fibroids call for either radium or surgical measures, according to the principles laid down on page 134. Retroflexions may require orthopedic or surgical treatment; if the latter, a curettage may at times precede the operative cure of the displacement, *and this is the only instance where a curettage is permissible in the treatment of leukorrhea.* Subinvolution of long standing often necessitates a hysterectomy. but not infrequently a combination of glycerin tampons in the manner described on page 279, and protracted hot douches, discussed and depicted on pages 161 and 318, will give relief. Chronic infections of the uterus and its vicinity may yield to the same combination of treatment, particularly if supported by protein therapy, but, on the whole, radical surgical removal will give more satisfactory results.

To go into further details would be a repetition of much that has been said elsewhere in this book. The main purpose of these lines is to emphasize that leukorrhea is a symptom of a number of morbid processes and that its cure

depends on an accurate differentiation and the proper selection of the therapeutic means at our disposal.

Protein Therapy.—Continued observation has confirmed in me the conviction of the fundamental and far-reaching value of protein therapy in inflammatory diseases of the female genitals. I have occasionally employed the pharmaceutical preparations of sterile milk in ampules, but, on the whole, I have seen no reason to discard the use of ordinary milk. The technic of preparation and injection has remained unaltered from the description given on page 342. Only one improvement has been added in the last few years. K. D. Graves, of Roanoke, suggested injections with centrifugalized and fat-free milk (*J. Am. M. Ass.*, 1924, 84: 1505) and I can fully subscribe to his claim that such milk produces no local irritation; both the general and focal reactions are greatly reduced without any apparent influence on the efficacy of the procedure.

My own experiences, which now extend over a period of almost seven years and comprise many hundreds of injections, have recently been presented in an article in the *American Journal of Obstetrics and Gynecology*, November, 1924, and correspond closely with those laid down in Chapter XXII of my monograph and thus require no repetition. An interesting observation not yet recorded by me concerns a case of large bilateral pus-tubes which subsided under milk injections. Some time later a laparotomy, performed for the relief of a retroflexion, revealed both tubes perfectly normal and patent. An identical case was reported to me by a friend and, in fact, I have received confirmations of my contentions of the value of milk injections from many quarters.

Where a simple and successful mode of treatment is employed widely, the danger of using it injudiciously looms large, and for this reason a plea for proper selection of cases and strict individualization of dose and interval is not out of place. It is not enough to point out the vast possibilities of this new therapy—its limitations, too, must be emphasized. There are several absolute contra-indications, such as cardiac decompensation, diabetes, and alcoholism. Whether pregnancy belongs to this group, is still an open question. Petersen enjoins great caution where there is a history of hypersensitiveness on the part of the patient (serum-sickness, asthma, urticaria, angioneurotic edema) or of epilepsy or other grave nervous instability. Above all, the state of the disease and the condition of the patient must be considered. Only if the cells are not hopelessly damaged or if the patient has not reached the state of complete fatigue, may milk injections be tried, lest they superimpose an extra demand to which the exhausted organism must succumb.

At no time should protein therapy be considered a cure-all; but even with all these restrictions and with all possible caution in the interpretation of the results achieved, protein therapy marks, to my mind, one of the greatest advances in therapeutics in recent times.

Pelvic Infections.—A survey of recent literature confirms the opinion expressed in the preface to my monograph four years ago, referring to the trend of modern gynecology towards non-operative therapy. This unmistakable tendency enables the practitioner to participate more effectively in the

treatment of gynecological ailments. It necessitates, on the other hand, a clear conception of the limitations of such treatment. In what cases or in which stage of a gynecological disease is a conservative therapy indicated, and when is an operation required? As far as fibroids and carcinoma of the uterus are concerned, these questions have been discussed on pages 136 and 147 of the monograph, respectively.

An equally concise statement is needed with regard to *pelvic infections.* The etiology, symptomatology and diagnosis of such infections were presented in Chapter V. Let us now briefly summarize our means of conservative treatment and refer for details to Chapters XIV, XVII, XVIII, XXII, and XXIII.

Acute Stage

1. Rest
2. Fresh air
3. Strengthening diet
4. Elimination

Subacute and Chronic Stage

1. Protein therapy
2. Heat
   (*a*) Prolonged hot douches
   (*b*) Diathermy (see below)
   (*c*) Dry heat
3. Glycerin tampons
4. Pressure weight treatment

I can only repeat what I have always tried to emphasize, that a suitable combination of these conservative measures will give far better results than adherence to any one single method. We should also bear in mind that any pronounced alteration within the pelvis must needs affect the whole organism; and even at the risk of indulging in truisms, I must reiterate that the pathologic physiology of the entire body should not be neglected over local modes of treatment.

The effect of this local and general therapy is, in the majority of cases, highly satisfactory. In certain cases, however, we cannot dispense with surgery and may well adopt the indications for operation, as formulated by Holtz (*Acta obst. et gyn. Scand.*, 1926, 4: 347):

1. In the febrile stage:
   (*a*) If there is a well localized abscess which can be incised and drained either through the abdomen or the vagina
   (*b*) In general peritonitis
   (*c*) If the infection of the adnexa does not yield to conservative treatment
   (*d*) If the diagnosis is uncertain and appendicitis is suspected
   (*e*) If, in a chronic infection, the life of the patient is in danger

2. In the afebrile stage:
   (*a*) For chronic pain
   (*b*) In relapses, unless the symptoms quickly yield to conservative treatment
   (*c*) If the diagnosis is uncertain, and tuberculosis, ectopic pregnancy or a malignant new growth cannot definitely be ruled out.

Diathermy.—In 1923, when my monograph first appeared, the discussion on diathermy was very brief, as this method had only then been introduced into gynecological practice. A fairly extensive personal experience now enables me to amplify my statements on page 324.

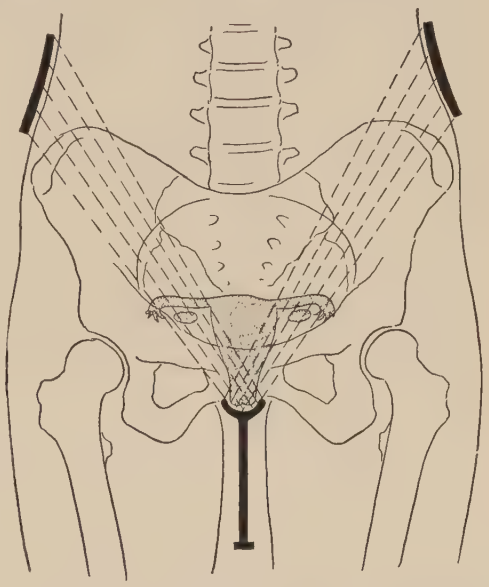

Fig. 1.—Heat Penetration by Diathermy (diagrammatic).

For the sake of completeness, I may be permitted to repeat that diathermy, as the name implies, is a method of heat-penetration which differs essentially from the ordinary utilization of heat in which heat is applied *from without* either through contact with a heating medium (hot douches, hot-water bag) or by radiation (hot dry air). In diathermy, heat originates *within* the body. A high frequency current of low voltage, by passing through the body or certain parts of it, transforms its electric energy into heat because of the resistance of the living tissues. The current flowing from an outer larger electrode to a smaller electrode in the vagina or rectum, thus heats the tissues through which it travels, particularly in the neighborhood of the smaller electrode, because the diminution of the size of the latter causes an increase of the density of the current whereby its heating power is proportionately increased. This explains why the penetration of heat transmitted from without and raising merely the temperature of the skin cannot be compared with the depth-effect of diathermy where heat ranging from 40° to 50° C. (104° to 122° F.) is produced within the affected tissues themselves.

Figs 1 and 2 show diagrammatically how this heat-penetration reaches the organs and tissues in the pelvic cavity. The heat primarily acts as a stimulant upon the vasodilator nerves within the affected zone. As a result, the blood-vessels dilate, and into these vessels rushes a large wave of fresh arterial blood. This serves, in the first place, to cool the tissues and prevent burns and, secondly, to wash away the waste products of former inflammations. The local metabolism, which had been retarded by the existing pathologic condition, is thereby restored more nearly to the normal. It would lead too far to discuss

the nature of the various biochemical responses of the body to heat, but the reader is referred to the footnote on page 324 of the original monograph. It is also possible that, in diathermy, obscure electric effects upon the organism are at work, perhaps in the sense of intensifying the vitality of the tissues.

Technic.—Diathermy is applied by means of a high frequency apparatus of which there are several models on the market. The manufacturers supply the necessary technical instruction. Many hospitals throughout the country have installed these apparatuses in their physiotherapy departments, where trained attendants can carry out the treatment according to the direction of the physician. Where such conveniences are not available, the practitioner should take a short course of instruction in some nearby center.

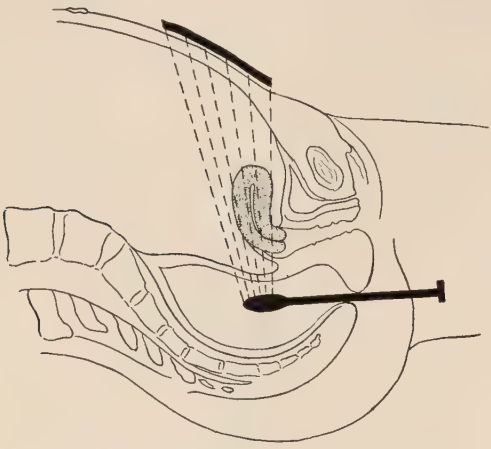

FIG. 2.—HEAT PENETRATION BY DIATHERMY (DIAGRAMMATIC)

Indications.—Diathermy is used in gynecology for four different groups of indications:

I. DIATHERMY IN PELVIC INFLAMMATIONS.—The term "pelvic inflammations" is not quite accurate, for in the acute stage no local treatment, and diathermy least of all, is indicated. Whatever the origin of infection had been, there is in all such cases an exudate either in the culdesac and around the pelvic organs, or within the loose connective tissue beneath the peritoneal covering of the pelvis. We call this condition pelvic peritonitis and pelvic cellulitis, respectively (see Fig. 56 on page 105 of original monograph). The exudate may suppurate and turn into an abscess, which then would demand immediate surgical intervention. If, on the other hand, with the passing of the acute stage, the intensity of the tissue irritation subsides, the exudate is gradually absorbed in part. A certain amount of the exudate, however, resists absorption. It may form dense and well-vascularized adhesions around the genital organs which, in some cases, are of considerable extent. In course of time these adhesions shrink and lead to dislocation of the organs to which they are attached. Thus the uterus may be pulled into retroflexion and firmly bound down to the culdesac, and tubes and ovaries may be affected in like manner. Similarly, intestinal loops and omentum may be drawn and immobilized in unnatural positions. It is obvious that such pathologic displacements and fixations must lead to anatomic changes and functional disturbances, and it is, therefore, not surprising that such patients suffer from profuse, prolonged, and painful menstruations, from backache and pressure upon rectum and bladder, leukorrhea, constipation, pain in intercourse, and many other discomforts which, while not dangerous to life, yet establish a constant drain upon the physical well-being and the nervous equilibrium.

If the exudate was, originally, in the pelvic cellular tissue, the unabsorbed portion may be transformed into unyielding scar tissue which transects and distorts the parametria; or it may remain in the form of masses of stony consistency which exert a continuous pressure upon subjacent nerve-trunks or interfere with the functions of rectum and bladder. In such cases there is often a constant pain along the course of the sacral nerves, marked discomfort in sexual intercourse and in locomotion, pain in defecation and other distressing symptoms which foredoom the patient to a life of invalidism.

That this picture is not exaggerated, may be inferred from the large number of women who come to our private consultation rooms and our clinics with complaints of this kind, complaints which, on examination, are explained by remnants of previous pelvic infections.

Until a few years ago, the therapy was almost altogether surgical, preceded at times by a more or less extended period of rest and indifferent conservative treatment. There is still a field for surgery; and a few pages back I have outlined the indications for operation in pelvic infections. But the practitioner must be clear in his mind that surgery, while unavoidable in certain cases, is never an ideal form of treatment. Conservative operations rarely yield the hoped-for results. We may be able to liberate the adherent uterus and adnexa out of their unnatural fixations, but we will not often succeed in preventing new adhesions upon the extensive raw surfaces. The liberation of a buried ovary is only too frequently followed by a considerable enlargement of that organ caused by cystic degeneration. Every experienced gynecologist knows how unsatisfactory, on the whole, is the outcome of partial operations upon inflamed tissues and organs, and how often the patient merely exchanges her old symptoms for a new set of, perhaps, even more distressing symptoms. Permanent relief, as a rule, can be achieved only by radical removal of the genital organs in their entirety, but as most of the patients are still in the sexually active age, such mutilation has its decided drawbacks.

There is, therefore, all the more reason to develop an intensive non-operative treatment. This, in its last analysis, aims at completing the absorption of the exudative remnants which the body was unable fully to accomplish. Restoration, like all progressive activities of the living organism, is brought about by active hyperemia, and as I have explained at length in Chapter XVIII, the best means of producing this hyperemia artificially, is by the use of heat. The superiority of diathermy over other forms of heat lies in the fact that considerably higher temperatures can be produced within the affected tissues themselves, and the greater the heat, the more intense will be the resulting hyperemia and the more pronounced its beneficial influence.

Though this remarkable method is still in its infancy, we already know that *subjective* improvement follows its employment rather promptly. Spontaneous pain as well as the pain of menstruation, in intercourse and at defecation subside rapidly. *Objective* improvement follows, in many cases, after a few treatments. Exudates diminish in size, and if not too old and too extensive, may disappear altogether. Adnexal tumors become smaller. Swollen tubes regain normal size and softness. Parametric infiltrations are softened,

and dense and unyielding adhesions may become so attenuated as to permit of greater mobility of heretofore firmly fixed organs. Not in all cases can a complete cure be accomplished. In a certain percentage, only an improvement is obtained, while there will always remain a certain number of failures.

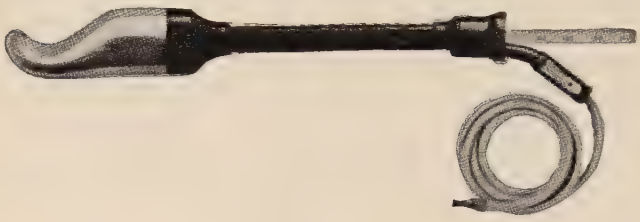

Fig. 3.—Vaginal Electrode with Thermometer

The largest statistics on the subject is found in the Inaugural Dissertation by Dittmer, of Kiel, in 1921. Of 937 cases treated, anatomical restoration was achieved in 372, or 39.4 per cent; subjective cure or improvement was noted in 447, or 47.3 per cent; while 115, or 12.1 per cent, remained refractory. It is to be noted, however, that Lindemann (*München. med. Wchnschr.*, 1915 and 1917) found that even in the case of failures, later operations were greatly facilitated by preceding diathermy because of the serous transudation and softening of the pelvic tissues.

As with all other therapeutic methods, the results depend to a large extent on the proper technic. My own experience has been obtained with an outer electrode of block tin, 3 inches wide, which encircles the waist of the patient, and a vaginal electrode which surrounds the cervix and thus attracts the electric currents from all sides (Fig. 3). Where the pathological condition to be attacked was located mainly behind the uterus, as, for instance, in posterior parametritis, the smaller electrode was placed in the rectum (Fig. 4). As to dosage, it seems wise not to start with too intensive a heat. As a general proposition, 115° F., as registered by the thermometer within the vaginal or rectal electrode, are the highest degree permissible; the heat in the tissues close to the electrodes is probably 4 or 5 degrees higher. Each treatment should last from twenty to thirty minutes. A prolongation of the treatment beyond this time would likely defeat its own purpose by paralyzing the vasodilator nerves. The number of treatments, which may be given at intervals of two or three days, depends on the individual case. The degree of heat and the duration of each treatment should be regulated according to the reaction of the patient. If there is discomfort, shorter sittings and lower temperatures are in order; both may be increased as the tolerance of the patient permits.

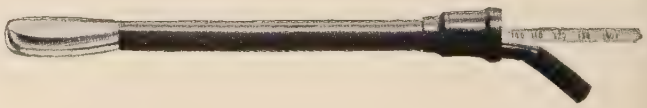

Fig. 4.—Rectal Electrode with Thermometer

The proper selection of cases for this treatment is of the very greatest importance. Just because it produces intense effects, diathermy may, if used injudiciously, do a great deal of harm. For this reason acute infections

which are about to calm down, must rigidly be excluded lest the inflammation flare up again. But even in subacute and early chronic stages, care is needed, and one can only agree with Guthmann (*Biologie u. Pathologie des Weibes,* ed. by Halban and Seitz, 1924, Vol. II, p. 545) who insists on keeping the patient under very strict observation. If the condition should be ever so little worse or if there be even a slight rise of temperature, the treatments should be interrupted temporarily and resumed only with considerable caution. It must, also, be remembered that the diathermic hyperemia frequently causes an increase and prolongation of the menstrual flow, and it is, therefore, advisable to discontinue the treatment two or three days prior to menstruation until a few days after its cessation.

The use of diathermy does not relieve us of the self-evident necessity of an exact diagnosis. We should be certain that the patient is not pregnant, for an intensive heat penetration might conceivably lead to abortion. Failure to recognize an ectopic gestation before commencing the treatment may well have disastrous consequences. Then, too, it must be borne in mind that diathermy exerts a marked influence on blood-pressure and pulse, and for this reason, we should subject to this treatment only those patients whose cardiac system is intact.

Only an uncritical enthusiasm can regard diathermy as a panacea. *There is no cure-all, and there never will be.* The advent of diathermy has not rendered older methods of treatment obsolete, and the best results will be accomplished by him who combines this new therapy with other tried means by which the defensive apparatus of the body is stimulated to energetic action. I have in mind such methods as the protein therapy, glycerin tampons, pressure weight treatment, gymnastics, etc. The physician who employs diathermy should realize that he has a great responsibility. Not only is the procedure capable of producing harm but its exclusive and injudicious use may quickly bring into discredit a method which has the faculty of restoring many sick women to health.

II. Diathermy in Gonorrhea.—The difficulty of curing gonorrhea in the female lies in the fact that the gonococci find in the para-urethral ducts of Skene and in the depth of the cervical mucosa a safe refuge from which they cannot easily be dislodged. Even after the stormy symptoms of a gonorrheal infection have subsided and the cocci have disappeared from the discharges under appropriate treatment, recurrences may happen when the germs sally forth from their hiding places as the result of sexual or alcoholic excesses, lowering of the general body resistance from chilling or intercurrent diseases, menstrual hyperemia, etc. It is, therefore, necessary to treat, in every case of gonorrhea, the ducts of Skene and the cervical mucosa separately. The destruction of the gonococci in these poorly accessible depots opens a promising field for diathermy. The results obtained are explained by the fact that gonococci are highly susceptible to heat and, in the test-tube, are killed at a temperature of 108° F. In the living, the degree of heat must be considerably higher because the organism is always intent to maintain a medium and constant temperature in all organs; and as soon as the tempera-

ture rises in any one place, fresh cooling blood is despatched to the heated zone to prevent accumulation of heat and consequent burn. For this reason, previous attempts at destroying gonococci by heat through hot baths or other hot applications have always failed. By diathermy, on the other hand, a

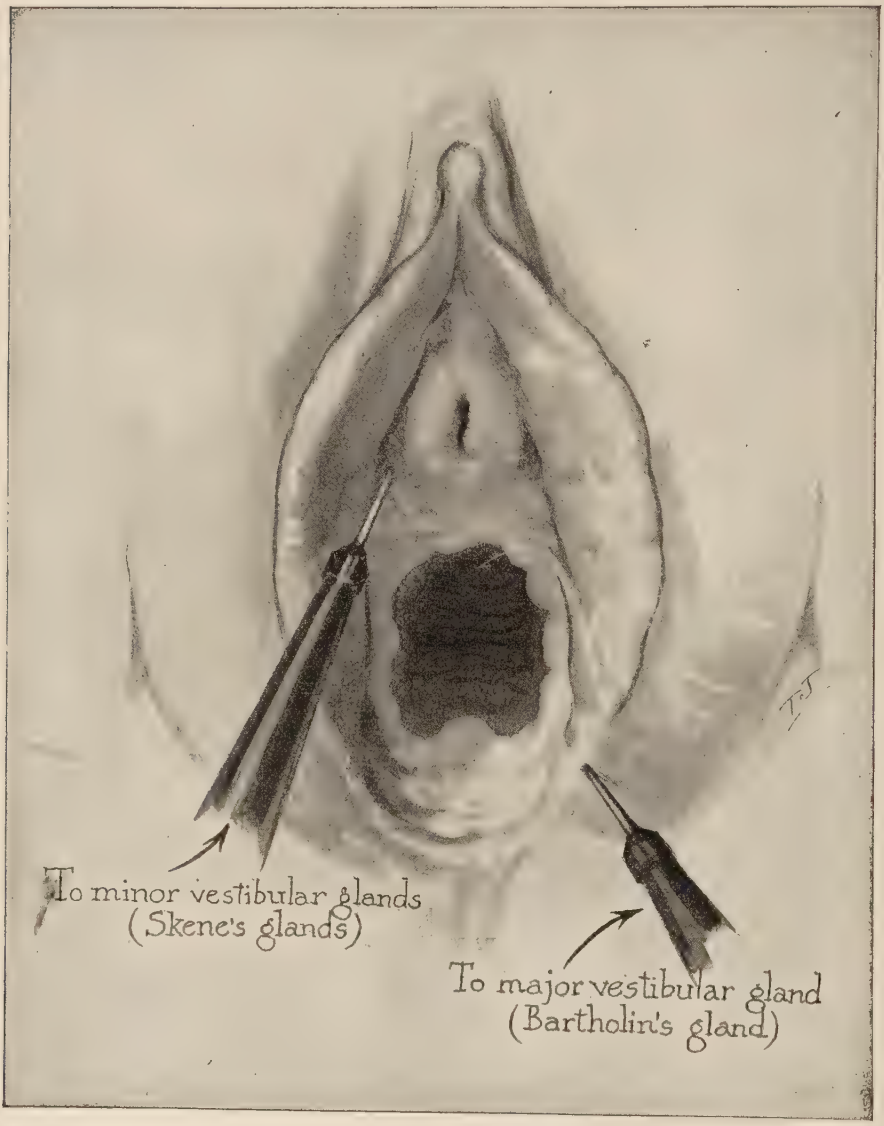

FIG. 5.—ILLUSTRATING THE METHOD OF APPLYING DIATHERMY TO GONOCOCCAL INFECTIONS OF SKENE'S AND BARTHOLIN'S GLANDS

(From, Corbus and O'Conor, *Diathermy,* Courtesy Bruce Publishing Co., St. Paul.)

temperature of about 115° F. can be maintained for some time, and this suffices to kill the bacteria in most instances. The technic is so well described and depicted by Corbus and O'Conor (Fig. 5) that I cannot do better than refer the reader to their book on *Diathermy* (Bruce Publishing Co., St. Paul,

1925). My personal experience is limited to 3 cases which had resisted all therapeutic efforts but were promptly and permanently cured by urethral and intracervical diathermy. Corbus and O'Conor record 48 cases in which diathermy treatment was continued to a complete cure of the urethral infection, and in only 3 was it necessary to treat the urethra more than three times. In cervical gonorrhea these authors have by intracervical diathermy succeeded in eliminating the gonococcus completely and permanently in many cases. Twenty-four women were observed repeatedly for three years, 38 for a period of two years.

Of other authors, Von Büben (*Deutsche med. Wchnschr.*, 1921, 47: 1427) obtained cures in 86 out of 110 cases, all of which were chronic and had resisted other forms of treatment. The average course consisted of ten applications which were made twice weekly for from fifteen to twenty minutes. After each menstruation, the cervical secretion was examined for gonococci. If none were found, treatment was discontinued but other smears were examined after the next two menstruations before the patient was pronounced cured.

P. J. van Putte, of Holland (abstr. in. *Gynéc. et obst.*, 1926, 14: 76) cured permanently "several very severe and refractionary cases of gonorrhea" with five hours of diathermy without any other treatment. He found that chronic or subacute cases reacted better than acute ones.

The technic is considerably more difficult than in general pelvic infections but is well worth the effort because it means a great advance in the treatment of gonorrhea.

III. Diathermy in Non-Infectious Gynecologic Conditions.—Lack of personal experience prevents me from speaking on this subject in detail. From the study of the literature, however, I infer that in some cases of dysmenorrhea highly satisfactory results have been obtained (Corbus and O'Conor). According to Theilhaber, cases of amenorrhea due to hypoplasia are likewise suited for diathermy because it leads to improvement in blood supply and consequent improvement in nutrition and growth. Heat-penetration has also been successfully used to stimulate the function of the breasts, and Guthmann (*loc. cit.*) vouches for the subsequent improvement in lactation. The same author, finally, calls attention to the relief which is often obtained by diathermy in the treatment of painful bladder irritations of a chronic nature.

IV. Diathermy in Cancer of the Uterus.—Cancer cells exhibit a paradoxical reaction to injuries of any kind. These pathological cells, which themselves are highly destructive, are in turn destroyed much more quickly than are normal cells, by mechanical, chemical, thermic and other stimuli. A cauliflower growth of the cervix uteri, for instance, is readily injured by the pressure of hard stools in the rectum, by the insertion of a douche nozzle, or in intercourse, and then offers no resistance whatever to the inroads of bacteria. Still more marked is the lowered vitality of cancer cells when they are subjected to heat. Corbus and O'Conor (*op. cit.*, p. 127) point out that malignant cells are destroyed by exposure of ten minutes to a temperature of 113° F., whereas normal tissue cells survive temperatures of from 132° to 140°. It is this fact which underlies the surgical application of diathermy

wherein heat beyond the physiologic tolerance of even normal cells is created in the tissues. The most practical method, according to the literature, seems

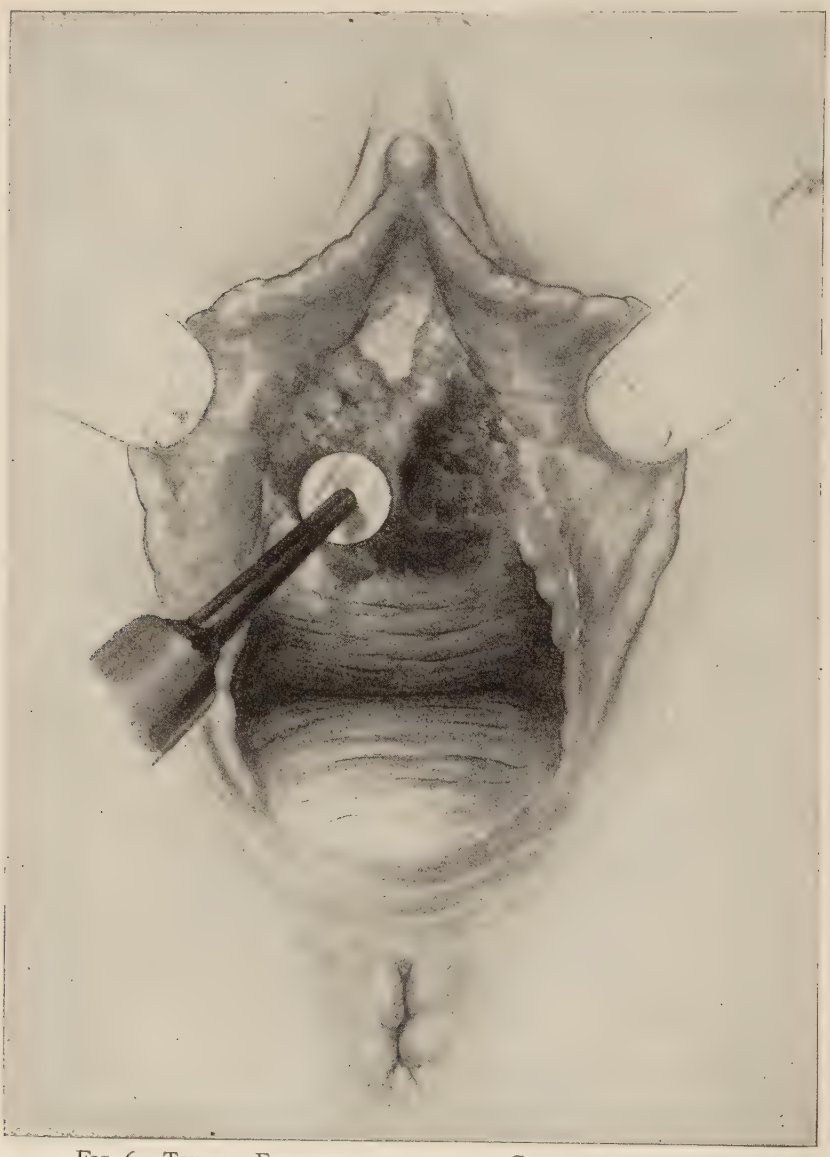

FIG. 6.—THERMO-ELECTROCOAGULATION OF CARCINOMATOUS AREA

Active disk-shaped electrode shown with tumor mass partially coagulated. Inactive electrode is beneath the sacral region. (From Corbus and O'Conor, *Diathermy*, Courtesy Bruce Publishing Co., St. Paul.)

to be that of electrocoagulation by which the treated tissues are very slowly heated until they have become white from coagulation (Figs. 6 and 7). The heat-penetration, therefore, extends far more deeply into the tissues than if fulguration, the hot iron, or the electric cautery are used; for with these latter

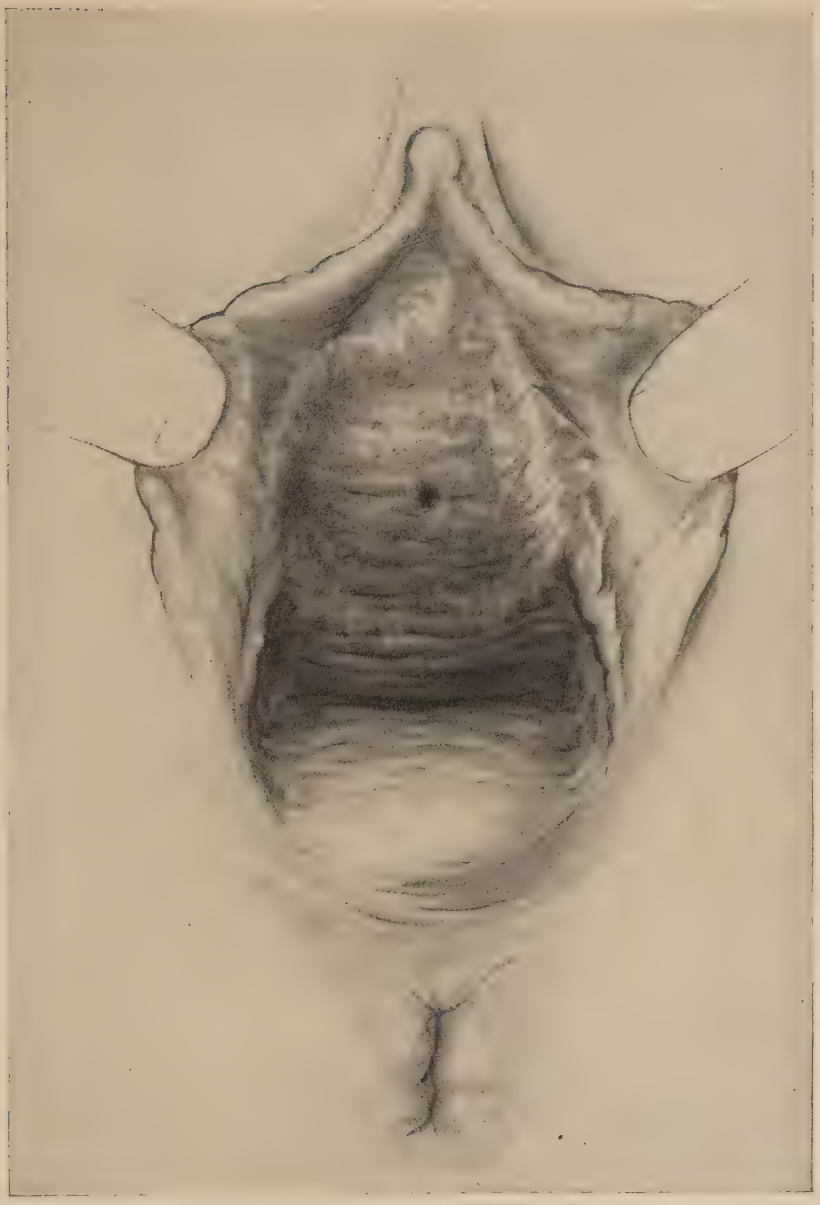

FIG. 7.—DRAWING MADE TO SHOW URETHRAL REGION AS SEEN SIX MONTHS AFTER DESTRUCTION OF TUMOR BY DIATHERMY

The entire region is completely healed and there is no evidence of local recurrence. The urethral canal is only 0.5 cm. in length but entire sphincter control is maintained. (From Corbus and O'Conor, *Diathermy,* Courtesy Bruce Publishing Co., St. Paul.)

agents, the surface is quickly carbonized, and the resulting eschar acts as a barrier to further heat dissemination.

In electrocoagulation, too, as with other forms of diathermy, combination with other methods seems highly advantageous. Very recently, Curtis (*J*

Am. M. Ass., Nov. 27, 1926) stated that he had employed electrocoagulation together with radium for the past three years and that the number of apparent cures of moderately extensive cases has greatly increased.

We may, therefore, say that in the realm of gynecology, the application of high degrees of heat by means of diathermy has placed at our disposal several important and promising methods of treatment of various pathologic conditions. For the present, practical experience has been accumulated in the therapy of chronic pelvic inflammations, gonorrheal infection of urethra and cervix, cancer of the uterus, and several minor gynecologic ailments. The pleasing results obtained should not, however, let us forget that the new method is only in its infancy, and that a great deal of careful clinical observation is needed to establish the possibilities and the limitations of this novel approach. Just because heat of this intensity is a powerful curative agent, it is also capable of causing considerable harm, and it behooves us to wield it cautiously and judiciously.

Headache.—Headache is one of the most common symptoms complained of by gynecological patients; and yet, strange to say, there exists no literature on the subject in the realm of gynecology and obstetrics. Sporadic references of a line or two, never more, may be found, but one would seek in vain for the word "headache" or its equivalent in the index of large reference works and textbooks. Kelly, alone of all gynecological writers (*Medical Gynecology*, Appleton, 1912, p. 224) devotes a section to this symptom, but he, too, treats it from the standpoint of general medicine. It goes without saying that any specialist, if he be true to his calling, should never forget that his own work is but a part of medicine, not medicine itself, and that he must know that headache may be produced by diseases of the brain (syphilis, meningitis, trauma, tumors), affections within the sphere of otorhinology, disturbances of the eyes, systemic lesions such as nephritis, and a multitude of other causes.

The gynecologist, however, must also be familiar with those types of headache which he is most apt to encounter in his daily work. These types may be grouped in two large categories: Those in which there is but a loose, if any, connection between the headache and the underlying condition, and those in which the headache is directly caused by the condition in question.

Foremost in the first category is what may briefly be designated as *nervous* headache. It is felt chiefly as a pressure on top of the head and as a pulling sensation in the occiput from where it extends to the back of the neck. Less frequently does it occupy other parts of the head. It is almost invariably associated with other neurasthenic symptoms such as insomnia, or, on the contrary, a very heavy, yet not refreshing sleep; frequent desire to urinate, more often by day than during the night; irritability; palpitations; hyperesthetic zones of the skin, particularly of the lower abdomen, etc. This syndrome is found in so large a number of widely different gynecological conditions that it cannot possibly be considered specific. Rather must it be explained on the ground of neurasthenia which is so common in female patients. In these, neurasthenic manifestations may break out under any strain, and often enough the wear and tear of mere living may be the exciting cause. If there

happens to be a more or less distressing pelvic lesion, the patient's attention is readily and quite naturally focused on the genital sphere, and the resulting worry is responsible for this particular form of headache and kindred symptoms. In order not to be misled into construing an imaginary connection between a pelvic condition and the headache, I have found it useful to prescribe bromids for such patients and make an appointment for a second examination three or four days later. By that time the headache and other nervous phenomena have disappeared, and the remaining symptoms may now safely be regarded as being due to the existing genital affection.

In patients with bleeding fibroids or other pelvic affections which give rise to protracted hemorrhages, we not infrequently encounter a headache which, as a rule, is located in the temples. This is the *anemic* form of headache and in no wise differs from that observed in any anemic individual. The appearance of the patient, her pale mucous membranes, her quick fatigue on slight exertions, and the low blood-pressure render a determination of the hemoglobin almost superfluous, inasmuch as the usual tests for the latter are highly unreliable; if there still be doubt, the red blood-count will clinch the diagnosis. Whatever form of therapy the underlying gynecologic condition may require, the coexisting headache calls for treatment of its own. Such treatment consists, in the main, of iron and arsenic and should be combined with cod-liver oil and a strengthening dietetic and hygienic régime.

When the nervous and anemic headaches are associated, as is often the case, a combination of the appropriate treatment must be instituted.

Toxic headaches are rather frequent in gynecologic patients. Their most common cause is constipation, which but rarely has any connection with any pelvic disease that may exist at the same time.

In former days, *reflex* headaches played a prominent rôle in the symptomatology of gynecological diseases. Retroflexion of the uterus, tumors of the ovary, in fact, every big or slight deviation from normal conditions within the pelvis were held responsible for the headache if that symptom happened to be in evidence. Since we gynecologists have ceased to ascribe any and every ailment to disorders within the genital sphere, the word "reflex" has disappeared from our vocabulary.

The second large category of headaches comprises the instances where this symptom seems to be directly caused by the pelvic condition. We may call these headaches *specific* and conveniently subdivide them as to their occurrence in gynecology and obstetrics.

In gynecology, we first have to mention *menstrual* headaches. This refers to individuals who suffer from headache only at the menstruation but are entirely free from it in the intermenstrual period. In some cases, headache is the only symptom complained of; more often is it associated with other disturbances of health at that time. The women are "unwell." There is a general lassitude both physical and mental; the gastro-intestinal tract is affected; the timbre of the voice suffers; an eruption of acne may appear; above all, a severe headache, unilateral or diffuse, may occur either immediately before or during the flow. While this form of headache has been explained by some

solely on the ground of vasomotor changes, the prevailing view now inclines to seek its origin in a sort of ovarian toxemia. This conception is strengthened by the very multiplicity of the general menstrual symptoms, and is reinforced by the fact that all these alterations of the general condition disappear quickly as soon as a sufficiently copious flow of blood has occurred. We are thus veering back to the old idea of the purifying effect of menstruation.

On the other hand, if ovarian secretion is produced in quantities insufficient to stimulate the uterus to menstruate, these symptoms seem to establish themselves more or less in perpetuity. Thus we find in many cases of oligomenorrhea and amenorrhea, and particularly in the climacterium, a syndrome in which frontal and temporal headaches and neuralgias of various cranial or peripheral nerves predominate. In some instances, astigmatism and other disturbances of vision, carious teeth, and the like may be the cause; but, as a rule, the regular occurrence of the symptoms mentioned points to the fact that chemically toxic substances are secreted by the ovary into the circulation for which there is no outlet. These substances have a definite vasomotor action, as evidenced by the well-known hot flushes in amenorrhoic and climacteric women. In the latter I have very frequently observed a phenomenon which I have never found mentioned in literature: A blinding headache which exerts an insufferable pressure just behind the eyes. If in such women, a tablespoonful or more of blood is taken from the uterus by scarification of the cervix, the headache disappears instantaneously, even before the patients rise from the examining table. Suggestion can altogether be ruled out, because the patients are not aware of the blood-letting. A venesection may, possibly, have the same effect; but of this I have no experience. These specific *climacteric* headaches occur in many patients quite regularly at intervals of from four to six weeks and always yield promptly to the same treatment, until the definite cessation of the ovarian secretion makes an end to this distressing symptom.

In the realm of obstetrics, headache is encountered as a conspicuous symptom in several conditions.

Many women present in the latter months of pregnancy marked changes of their facial appearance. The nose becomes broader, the lips thicker, the cheeks are more prominent and the ear lobes enlarged. Often the fingers, too, seem to swell so that rings have to be removed. With it, there is a steady and at times severe headache, and yet, blood-pressure and kidney function remain perfectly normal. We have to deal in such cases with a physiologic hypertrophy of the hypophysis due to pregnancy which, after childbirth, gradually resumes normal proportions with concomitant disappearance of the symptoms mentioned. This *pituitary* headache, therefore, is not amenable to treatment.

Much more serious is another form of headache which occurs in pregnant women who also exhibit an increase in blood-pressure, albuminuria with reduction of the urinary output, edemas, and disturbances of vision. Such women are in a preëclamptic state which will terminate in true eclampsia with convulsions unless appropriate treatment is instituted without delay. This pre-

eclamptic headache, which is one of the manifestations of a toxemia, requires no separate treatment; it disappears spontaneously if the suitable therapy has been successful in eliminating the poison.

Still another form of toxic headache is that found in cases of puerperal fever where bacterial toxins have entered the circulation. Its relief depends on the means employed to combat the existing sepsis.

As we now look back over the field just traversed, we realize that headache in women, though it is a very common complaint, has, in the great majority of instances, little if any relationship to the gynecological condition present. It appears in various types which are the same in men and women, and may be produced by a multiplicity of causes.

Only in a comparatively small number of patients do we find headaches in which a direct causal nexus between them and the pelvic organs can be established. This list comprises in gynecology the headache of the menstruation, of amenorrhea, and of the climacteric; and in obstetrics the headache caused by hypertrophy of the hypophysis in pregnancy, by the preëclamptic state, and by puerperal sepsis.

The list is small but to us it is very important, because in these few conditions the symptom of headache has pathognostic value. It may guide us towards the right diagnosis and thus to appropriate treatment.

SURGERY OF THE FEMALE PELVIS

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POSTOPERATIVE MANAGEMENT AND COMPLICATIONS

The management of convalescence following surgical operations commences with the return of the patient to her room where she at once comes under the care of a specially detailed nurse. The room has been freshly aired and is at a temperature of 68° or 70° F. The bed is warmed by an electric pad or hot-water bottles in flannel bags, the light is subdued and only those necessarily in attendance are admitted to the room. In hospital practice it is desirable that there be maintained, in a quiet wing of the building, a small recovery ward to which patients occupying ward beds are brought for the ensuing two or three days.

During the time that the patient is unconscious and relaxation complete, her head is turned to the side, without a pillow beneath, and the lower jaw is supported until there is no longer danger of the tongue falling back over the flaccid glottis. Under the more advanced methods of anesthesia, however, such prolonged relaxation seldom obtains, so that by the time the patient is back in her room consciousness is either restored or is returning. Where such is not the case, oxygen gas may be administered and the foot of the bed elevated, thus assisting in overcoming shock or even a tendency toward shock.

Even when drainage has been employed, lowering of the head is a wise precaution for a few hours following operation, and is always indicated when this has been an unusually serious one, unduly prolonged, exceptionally traumatic, or attended by more than the ordinary loss of blood. Only rarely is it necessary to place the patient in the Fowler position immediately.

As a rule, for the first two or three days, the patient will be most comfortable on her back, her head on a pillow. The greatest relief from suffering accompanies the most complete rest, and turning her from side to side only increases pain. Moderate flexion of the legs by placing a pillow beneath the knee affords a measure of relief at times. Only in the exceptional cases demanding abdominal drainage is the lateral position of advantage and, when this is indicated, the lateroprone attitude is best.

The reaction to major operations is so severe that the patient is usually quiet, commotion being more frequent after minor or plastic procedures. Restraint, while seldom required, may become necessary in the case of the neurotic

or hysterical person who is noisy and may even attempt to escape from bed. In case of the patient subject to some definite mental disorder not only may her condition make necessary restraint in bed by straps or sheets, but the windows of the room should be barred.

Postoperative management depends very largely upon the type of operation performed. As a rule those carried out by the abdominal route are classed as major procedures and those by the vaginal route as minor. The subject may, therefore, best be considered in its application to one or the other of these routes.

ABDOMINAL SECTION

Pain.—During the first twenty-four hours after operation the patient suffers from pain in greater or lesser degree. At times this pain is limited to the wound but oftener it is due to tension, when the parietal peritoneum is involved, as in ventrosuspension, or when the broad ligaments are pulled upon, as in round ligament shortening. More pain is experienced in the lateral, muscle-splitting incision than in the median wound, through the linea alba. When the pain is not so severe as to produce restlessness or wakefulness the patient is better without a narcotic, but this is rarely the case, and sufficient sedative must be given to prevent the exhaustion and depression subsequent to severe or prolonged suffering. Morphin sulphate (⅛ to ⅙ Gr.) is given during the first night, usually at once after operation, since the pain is then at its worse. While morphin favors distention, thus tending to unsettle the stomach, flatulence seldom appears until twenty-four hours after operation. Peritonitis and intestinal obstruction, which are masked by morphin, rarely develop until after forty-eight hours. Morphin is never given by routine but only as each dose is specifically prescribed and, in any case, if prolonged is most undesirable. Heroin (1/12 to ⅙ Gr.) alone or combined with pyramidon (Gr. v) provides a satisfactory substitute in ordinarily severe cases. This may be given every eight hours for three days following operation.

After the pain of trauma has passed or been allayed, morphin is contra-indicated, distress now being due to intestinal colic for which free evacuation of the colon and rectum is the treatment. Neurotic patients will complain of great pain and show extreme restlessness, though pulse and temperature are normal and distention is absent. Morphin here is particularly to be avoided, anodynes being of as much value. Where the pain during the first day is out of proportion to the nature of the operation and to the temperament of the patient, especially if the pulse is unduly rapid, some trouble at the operation site is to be suspected. Pain unduly severe after forty-eight hours is the result of distention, peritonitis, or intestinal obstruction.

As regards the ordinary gas pains, so common after abdominal section, they indicate activity on the part of the bowel, particularly of the small intestine. Nothing is so ominous as an absolute absence of pain or distress at once after operation, a condition strongly suggestive of shock and paralytic ileus. While no surgeon wants his patient to suffer unduly, the appearance of the well-recognized gas pain at least means that the bowel is active.

Accompanied by the passage of flatus, the abdomen remaining soft, this is a fortunate sign, and contra-indicates, rather than demands, much medication.

Relief from pain is not so urgent and often not required when the operation has been preceded by the administration of an opiate. Morphin and atropin prior to operation was for years a routine practice and remains the routine with many surgeons. In the practice of others the combination of morphin and scopolamin, the "twilight sleep" of obstetrics, is employed and constitutes the main feature of the surgical anesthesia. Operators employing methods of local anesthesia also often precede those by scopolamin-morphin narcosis. Naturally, in methods such as these, with whatever variable and elastic changes they may be modified, postoperative analgesic treatment is reduced to a minimum.

With the perfection of gas-ether administration, and particularly in cases in which nitrous oxid gas or ethylene gas may be used without ether, all preliminary narcosis is best omitted and atropin is unnecessary. In my practice the administration of nitrous oxid or ethylene gas, with or without ether, has become the method of choice, and the postoperative use of morphin sulphate or heroin hydrochlorate is not only desirable but necessary. Given at this time the drug is employed in the minimum dosage essential to the relief of pain, its one and only indication.

Restlessness or insomnia may persist at times without a continuance of pain, and in such cases physiological methods of treatment are often sufficient. A sponge bath, a change in the patient's position in bed, gentle massage, a pillow under the knees, are small things which serve to induce sleep or bring about composure. Sleeplessness is seen without pain in various patients, especially if exposed to the disturbing influences of the large ward. Here again is an argument for the isolation ward following laparotomy. For the patient who is restless through sheer anxiety or nervousness, no drugs are more effective than the bromids, occasionally with the addition of chloral. Persistent insomnia is a sign often preceding or accompanying peritonitis, intestinal obstruction, and postoperative insanity. It is also a result of toxic absorption, as from the operation area. The ability to sleep readily after operation gives excellent prognosis for a speedy and uneventful convalescence.

Emesis.—While regarded as due chiefly to the anesthetic, vomiting occurs more frequently after abdominal sections than after operation on other parts of the body. Hence it results in part from invasion of the peritoneal cavity, handling of the intestines, and extirpation of organs invested with peritoneum. While ether is, without doubt, the most generally employed anesthetic agent, there is an evident advantage in the use of gas-ether combinations. Not only does the patient awaken more speedily, but vomiting is definitely decreased. In short and relatively superficial operations, making possible nitrous oxid-oxygen or ethylene gas-oxygen anesthesia, no vomiting at all occurs in a fairly large proportion of cases. It is less persistent and less violent, if present at all, when little or no ether is employed, as in the preoperative morphin-scopolamin narcosis or in local anesthesia, by infiltration, nerve blocking, intraspinal, and like methods. It should be noted as well that patients poorly

prepared for operation, or those acutely ill and suffering from emesis prior to operation, will have more after-distress. Speed of work, handling tissues gently, avoiding the intestine as much as possible, limiting the field of manipulation to the pathologic area, and like measures in technic have their importance from the prophylactic point of view.

In the routine work of the clinic, however, there will be that series of cases in which the anesthetic must be profound, for deep pelvic work, extensive enucleation, or careful peritoneal toilet, and in which ether is the only means of securing relaxation and exposure. In such cases postoperative vomiting is anticipated and usually experienced. This was formerly regarded as a symptom of gastric catarrh and Herman taught that the stomach should be kept empty, a treatment difficult to carry out because of the patient's thirst. Ashton has advocated oxygen inhalation until consciousness begins to return, when vinegar is substituted until the patient is awake. Anesthetic vomiting rarely lasts more than a few hours, but when gastritis has been produced, it may be prolonged for a day—the "irritative" form of Bonney and not associated with untoward symptoms such as fever, rapid pulse, or abdominal rigidity.

Neurotic patients often display the most intractable vomiting, cases in which there is little or no reason to suspect any grave intra-abdominal lesion, and in which all methods of treatment are of no avail. The amount of fluid expelled does not increase and the only harm is that food is not taken or retained. Occasionally the vomiting ceases for no apparent reason, and often the employment of some unusual artifice will suffice. Placing an ice-bag over the epigastrium, or a weak mustard paste may serve the purpose. A small amount of brandy in hot water taken at once after emesis is at times successful in alleviating further difficulty. In prolonged cases all food is stopped by mouth and nutrient enemata are given after colonic flushing and gastric lavage. The latter procedure is often sufficient in itself. Washing out the stomach with a tube may so distress a neurotic patient that there will be no further emesis.

The most effective measures, were it not for excessive thirst, would be to keep the stomach empty and to flush the colon with soapsuds enemata. But fluid taken by mouth, especially if cold, is often retained, accumulating in quantity until vomited. Undoubtedly the most distressing nausea is that in which the stomach is relatively empty, containing but a small amount of its own secretions. Lavage in such cases is the most effective treatment but, since the passing of a tube is in itself distressing, the same end is attained by having the patient drink hot water. If nausea without vomiting is present, hot water in teaspoonful doses is given every few minutes. But as long as the patient vomits she is encouraged to drink hot water freely, in as large amount as she can be made to take. If vomited it comes up easily, without the retching and gagging so often seen years ago. The stomach is then quiet for a time and eventually the water is retained, the stomach is washed out downward, and then sodium bicarbonate is given in half-teaspoonful doses with each subsequent glass of water.

After vomiting has ceased food is given at once. As a rule liquids are

well taken, but some solid food, such as egg-albumin and toast with tea, in small quantities, is of greater value. After the first bowel movement soft food is allowed. In the absence of flatulence milk and milk foods are given. When nausea and vomiting have continued beyond forty-eight hours, evidences of peritonitis are sought.

Thirst.—After a major operation the first complaint of the patient upon awakening is often that of thirst. This is due to loss of fluid by free perspiration during operation, to the loss of blood and serum incident to the operation, and it is probably, in some degree, one expression of reaction to the physical assault of operation. When atropin has been administered as a preoperative measure there results a dryness of the throat, giving the patient the sensation of thirst. This has not been a factor in my practice during recent years, since gas-oxygen or ether-gas-oxygen anesthesia has been employed, preceding which morphin and atropin are not given. Thirst is prevented, therefore, by the copious ingestion of water during the day or two prior to operation, and by the administration of a pint of tap water, or normal salt solution, per rectum at once after the patient is returned to bed. Thereafter 6 ounces of saline solution are injected every few hours.

As soon as the nausea ceases and hot water taken by mouth is retained, there is no further complaint of thirst. The water should not be given warm, which is unpleasant to many people, but as hot as tea is ordinarily drunk, so that it may be sipped from the spoon. Cold water, or chipped ice, may be more refreshing in the mouth, but it does not allay thirst so well and is more apt to induce accumulation in the stomach, being actually harmful if flatulence coexists. During the entire convalescence the patient is encouraged to drink freely of water, especially the still mineral varieties.

When the patient is definitely toxic, or when, as in the case of prolonged inflammatory disease, such as chronic pelvic peritonitis, acidosis may ensue after operation, the enemata are alkalinized, or combined with glucose solution. Bicarbonate of soda is given by mouth as soon as hot water is retained. In some of these cases in which the patients are badly run down, a preoperative carbohydrate feeding is well indicated, together with the elimination from the diet of meat and eggs for a period of several days. After operation, instead of the normal saline solution every four hours, a solution of malt sugar or 20 per cent dextromaltose is substituted. This is continued for several days, or until the urine is only slightly acid. This method of alkalinization not only tends to prevent or overcome thirst, but has a definite influence upon nausea, distention, and the healing of the wound.

Temperature, Pulse, Respiration.—The rate of the pulse and respiration and the degree of temperature are taken and recorded by the nurse every six hours during the first ten days, and twice daily thereafter in the absence of complications. If the patient is too restless, or is hysterical or unconscious, the *temperature* is taken more accurately by the bowel. As a rule fever does not rise above 101° to 102° F., often not exceeding 100° F. This postoperative rise is highest on the second day, thereafter dropping to 99° F., becoming normal after the bowels are evacuated. A temperature maintained

at 99° or 100° F. for a week has no special significance, but a rise after the bowels have moved suggests beginning suppuration in the wound or a circumscribed peritoneal infection. Persistently high temperature indicates a stitch abscess in the abdominal wound, especially if associated with local pain or soreness. Nervousness, worry, or the annoyance of too many visitors often causes a sudden rise of fever, which is not maintained but subsides with rest.

Quite the most satisfactory guide with respect to the patient's condition after operation is the *pulse*. As a rule its course is high or low proportionately with the temperature. Its rate does not go beyond 100 during the first three days of normal convalescence, and declines after bowel elimination. During the first twenty-four hours the pulse rate varies according to the length of the operation, its character, the amount of blood lost, and factors of such kind. The anesthetic and preoperative narcosis also has its influence, the pulse being slowed down if scopolamin or like drugs have been given. For this reason, as an indication of actual conditions the pulse is most reliable, again, when ether-gas or gas-oxygen anesthesia has been employed.

In the normal case the pulse should run about 80, full, even, regular, and soft. An increase at this time, following free catharsis, is indicative of infection, especially if coincident with some fever and abdominal tympany or rigidity. A rate of 115 to 130 after the second day shows a serious condition, while a rate of 140 goes with other signs of shock or hemorrhage. In hysteria or other states of excitation the rate is increased temporarily.

Rapid *respiration* soon after operation indicates shock or hemorrhage; later it is associated with peritonitis, intestinal obstruction or pulmonary complication. With much abdominal pain the patient breathes more superficially and hence with a slightly increased rate. After the second day, or upon the cessation of vomiting, respiration becomes relatively normal, full, deep, rhythmical, varying slightly about 20 to the minute.

Mouth and Tongue.—Frequent cleansing of the mouth is a grateful relief to the patient, the nurse using a cool solution of boric acid or a modified Dobell's. Artificial teeth are not restored until vomiting has definitely ceased. A soft toothbrush is employed as soon as the patient has recovered sufficient strength. The tongue shows characteristic changes according to conditions. After the first day it is moist but remains white as long as the diet is liquid. In the severer forms of infection or obstruction, particularly with fever, it becomes dry and brown, fissured and red, or ulcerated. In such case the lips become chapped or fissured and require annointing frequently with olive oil or a bland ointment.

Diet.—Feeding by mouth should not be attempted until the stomach is quiet. By our modern methods of anesthesia, however, emesis is often absent and seldom prolonged. Hence the ingestion of food may be started early. For the first twenty-four hours after operation the patient will most probably have no desire to eat, but if she does she may be given egg-albumin, beef juice, or weak tea, and, in some instances, even a slice of buttered toast. After the first bowel evacuation soft diet is given, light diet by the fifth or sixth day, and the full tray substituted for the second week. Milk is best

omitted, particularly during the stay in bed, as it increases flatulence and may prolong nausea and vomiting. Milk is a solid food after its ingestion and must be used with discretion. As a rule it is best taken in a peptonized form or with lime water. It is also acceptable in the form of cooked foods, such as puddings and custards.

Orange or grape juice, unsweetened, is agreeable as soon as liquids can be retained. Alcoholic stimulants are given only on definite indication and have a certain value, the best forms being brandy, sherry, or champagne. Formerly we gave an ounce of whisky added to the first retention enema, as a routine. A wine glass of sherry, two or three times daily, after the first week, may be given with value for a few weeks after operation.

Where the operative procedures have involved the intestinal tract, as in appendectomy, the dietary as outlined is to be advanced somewhat more cautiously, any considerable amount of food, and all solids, being withheld during the first three or four days. On the other hand, prolonged gastric distress, not due to some actual complication, does not contra-indicate solid food, many patients doing better as soon as liquid diet is discontinued. After regular diet is in order, nourishing liquids, such as hot chocolate, malted milk, eggnog and fruit juice, are offered between meals.

Again it is worth while to emphasize the importance of alkalinization and glucose proctoclysis as a means of preventing or combating acidosis. This may exist, unsuspected, before operation and be the cause of prolonged emesis after, or it may follow as the result of vomiting. The essential element lies in the depletion of the alkali reserve in the blood, and starvation acidosis must be counteracted before any hope can be entertained of establishing food balance. It is claimed by some that acetone formed as the result of the action of ether upon the organism together with the by-products of a rich protein diet following operation, are responsible for many postoperative discomforts, even for faulty wound healing. Hence the preoperative feeding of milk-sugar and sodium bicarbonate instead of milk and eggs and the continuance of soda and glucose solutions after operation, as has been previously outlined.

Management of the Urinary Tract.—This constitutes one of the most important features of postoperative care. After abdominal section most patients are able to void spontaneously, but such a large proportion requires some assistance in this respect, and infection of the bladder is a complication so distressing and so potentially dangerous, that every measure should be taken to avoid it. According to Curtis, 66 per cent of his patients subjected to major gynecological operations required no catheterization, 11 per cent required it once, 5 per cent required it twice and 17 per cent required it three or more times. Mills' report shows that of 321 abdominal operations upon the pelvic organs, 145 patients, 45 per cent, required catheterization. Mills also found that women are more liable to bladder disturbances than men, as is shown by the figures in one group of 420 patients, male and female, in which the operations and treatment were the same. In this group, 3.1 per cent of the men and 23.1 per cent of the women required catheterization.

In the case of that patient who does not void spontaneously, effort is made

to induce urination every eight hours. Micturition is encouraged by local hot applications, by steaming water poured into the bed-pan, by external douching with warm water, and such methods. The application to the urinary meatus of some stimulating substance, such as drop of spirits of camphor, is employed successfully at times. The best form of diuresis consists in increasing the amount of fluid to be excreted by the normal saline enemata previously referred to and by the copious drinking of hot water. Eventually the patient is allowed to go four more hours before catheterizing her. In other words, attempts at inducing urination are made every eight hours, catheterization every twelve hours. As in postpartum convalescence, a patient finds it difficult to void while lying on her back; conditions permitting, it is better to support her in a sitting or reclining position on the bed-pan than to use the catheter. Where the ability to void naturally is once regained it is apt to be retained regardless of position. Occasionally, too, a patient is unable to void spontaneously as long as she is confined to bed but does so without difficulty at once upon arising. Again, nervous irritability and bladder difficulties are commonly associated.

The first specimen voided after operation, or obtained by the catheter, is sent to the laboratory. After that, analysis is made only as may be indicated by special conditions, though twice weekly is not too often as a routine. The total excretion is diminished during the first three days and more or less vesical irritability is occasioned as a result of concentration. Hence it may be advisable to measure and record the total daily output.

Emphasis must always be placed upon the technic of surgical cleanliness in the use of the catheter. This need not be detailed here but the nurse should have adequate assistance in the performance of such a procedure which, though minor technically, is of major importance. Assistance is invariably necessary when the patient is unconscious, is struggling from nervousness, pain or hysteria, or when she is delirious. In some cases the urinary meatus is difficult to find. Then the head nurse, or the resident or attending surgeon, is called.

For a long time it has been believed that postoperative cystitis results from infection due to imperfect technic in catheterization. To-day such infection is regarded as secondary to the contamination of residual urine. Of the 66 per cent of patients in his series in whom the use of the catheter was unnecessary, Curtis found residual urine in less than 1 per cent. But of the 17 per cent, 269 patients, requiring catheterization three or more times, residual urine was found in 64 per cent. The amount of this residual retention decreases gradually as the bladder regains its power of complete evacuation, a period usually varying from four to eight days.

According to the present plan of treatment the catheter is used for the relief of distention, rarely oftener than every twelve hours. If this has occurred more than three times the patient is catheterized daily immediately after one urination and this is continued until the residual urine has disappeared, or is less than 1 ounce and free from pus. During this time the urine is rendered acid by sodium acetate, and hexamethylenamin is given in

quantities sufficient to reveal free formaldehyd. After each catheterization 1 or 2 ounces of silver nitrate solution (1:3000) may be left in the bladder, particularly if the hexamethylenamin is omitted. After plastic operations involving the bladder itself the test catheterization for residual retention is advisable for a few days even if the patient is voiding spontaneously. Furthermore, it is unwise to stop suddenly the use of the catheter when micturition becomes spontaneous, for the reason that the bladder is usually unable to empty itself completely for several more days. The residual urine, thus accumulating, becomes contaminated and gives rise to cystitis, the same as it does in the first instance.

Management of the Bowels.—The postoperative care of the bowels depends largely upon preoperative preparation. At the present day it is generally understood that catharsis beginning the day before abdominal section, particularly that intestinal evacuation formerly described as "thorough," does more harm than good. It causes the patient to have a disturbed and restless night, it produces psychic and physical weakness, loss of body and intestinal fluids, change in the bacterial flora of the bowel with hypertonicity of its wall, and irritability of rectum and colon. The postoperative thirst is greater and the gas pains are more marked. To-day drastic purgation as a preparation for operation has been abandoned. A mild laxative the night before and an enema the morning of the operation are regarded as sufficient in many clinics. In others a laxative is given two days before and an enema the evening before. A few surgeons continue the purge and enema before operation, others have come to omit all except the enema and a few object even to it.

The old-time system of preoperative starvation has also been discontinued. A light meal the evening before, or fluids only, may be wiser in anticipation of surgical procedure involving the gastro-intestinal tract directly; but for gynecological operations this is less important, and the omission of the meal preceding the anesthetic is, in most cases, sufficient. As food leaves the small intestine within twelve hours after taking, nothing is gained by withholding it—if easily digested and in moderate quantity—up to this time. It is desirable, in lower abdominal procedures, to have the colon empty and, hence, a high enema shortly before operation will suffice.

In considering the treatment of emesis and pain, the use of the enema was discussed. Its value, then, is rather from this point of view than from that of evacuation of the bowel. Hence, purgation need seldom be hurried, but may usually be put off until after the third day. Where the stomach is unsettled, little is gained by giving cathartics by mouth. Some authorities prescribe calomel in divided doses as early as forty-eight hours after operation, following it by enemata of soapsuds and glycerin. Others employ magnesium sulphate or castor oil by the end of the second day if the stomach is settled, with an enema to follow of turpentine and soapsuds.

On the contrary, certain authors in the more recent literature argue against the postoperative cathartic. Thus, Taylor and his associates report interesting observations in the care of a large series of patients. They divided these into three groups: (1) Those purged before and after operation, (2) those

not purged before but purged shortly after, and (3) those not purged before and who were given no enema or cathartic for at least four days after operation. The omission of the preoperative purge had no definite influence on the vomiting but reduced pain from 75 per cent to 42 per cent. Delay in giving the postoperative purge reduced emesis from 45 per cent to 30 per cent. In both groups complaint of pain was greater when the postoperative purges and enemata were withheld. Howard gave a postoperative cathartic in the treatment of 200 cases of peritonitis, and obtained better results by thus allowing the patient to remain quiet than he had secured previously by the routine use of calomel. The tendency to give cathartics too soon after abdominal section is also deplored by Bell who relies chiefly on the enema. As soon as peristalsis is once well started it usually continues actively, so that simple laxatives, such as cascara sagrada, or podophyllin, or the aloin-belladonna pill, are not required during the patient's stay in bed.

While most women are chronically constipated, some are not and these latter will reveal as much distress during the second and third weeks from ordinary laxatives, for instance, as they do at once after operation. Routine treatment is essential in hospital practice, especially in the larger wards, yet the routine should be so flexible as to be readily adjusted to the individual requirement of each patient. In most cases this adjustment is toward repeated efforts to overcome chronic intestinal stasis, particularly that type aggravated by the mechanical sagging and developmental loss of tone characterizing enteroptosis. In such a case, postsurgical, repeated enemata are required, soap and water, containing an ounce of glycerin or a half ounce of turpentine, or, glycerin and sweet oil combined, placed as high in the colon as possible by means of a long tube. The treatment, however, is for the immediate convalescence only. As soon as conditions allow that food be taken, treatment of the spastic constipation is begun by a carefully formulated dietary. It is always best if the patient can be well started on this plan before leaving the hospital.

It has been shown by Soper that, in the type of patient under discussion, spastic contractures of the lower colon and rectum play an important part in the etiology of chronic constipation and, as well, of postoperative gas pains and abdominal distention. Soper advises that this condition be treated by the injection through the rectal tube of 3 ounces of a saturated solution of magnesium sulphate, with the hips elevated in order to promote as long a retention as possible. This is repeated every day or several times daily, with no signs of toxicity even when the enema is retained as long as twenty-four hours.

During the early postoperative days the colon tube is of definite value as a means of relieving the patient of flatus. Postoperative distention is one of the first conditions calling for treatment and has been discussed in previous paragraphs. Tympany rarely appears before the second day and, if there is any delay in the expulsion of gas, or if the abdomen is seen to be distending, the colon tube is passed at once. It may be passed several times a day and may be left in the bowel for a half hour or so at a time. In this way flatus is expelled readily, without the painful bearing-down effort on the part of the

patient, an effort, indeed, which she often will not make because of pain, or cannot make because of muscular trauma. Aid in the expulsion of gas is lent by strychnin sulphate (1/20 Gr.) or an ampul of pituitrin, injected hypodermically. Pituitrin is particularly effective in the more obstinate forms of simple distention, in paralytic ileus, and in the cases already referred to as characterized by muscular insufficiency and ptosis. Eserni salicylate (1/40 Gr.) is always mentioned in this connection, and is highly regarded by many writers. Stevens uses it in association with digitalis (1/50 Gr.) and strychnin sulphate (1/60 Gr.) Eserin has proved of little value in my experience. On the contrary pituitrin is very helpful in its limited field. Its influence is temporary, so that it may be required in repeated doses. In pathological hypertension it is contra-indicated, as it is in intestinal obstruction and ileus due to peritonitis.

Care of the Wound.—When the wound is closed as described in the original monograph, Section VI, page 200, it is left untouched until the fifth day when the gauze roll beneath the retention sutures may be removed. Then, if the abdomen is soft and flat, the sutures may be retied. In case of abdominal distention the roll had better be left in place. Indeed, it is not necessary that the roll be removed and the wound may be left untouched until time for removal of the stitches. When the superficial skin drain, such as is advantageously placed in the obese abdominal wall, has been used, this is withdrawn on the second day, not later than the third, again necessitating change of dressings. Aside from these exceptions the wound is not disturbed unless there is fever, pain in the wound, or the dressing is soaked with blood or other discharging fluids. In redressing fresh gauze is used throughout, the original adhesive strips being replaced by short straps, adherent laterally and tied together over the dressing by tapes.

Some experienced surgeons seal the wound with strips of gauze bandage and collodion, and this is covered, in turn, with several layers of gauze and adhesive plaster. After five or six hours the outer dressing is removed and an ice-bag is placed over the wound for the purpose of allaying pain. The sealed wound heals very well in case of the thin abdominal wall. In the few cases requiring drainage, however, this dressing is impossible and in case of the fat wall, where the wound juices often ooze for two or three days, the collodion-gauze dressing serves only to retain these discharges. Free drainage is one of the best assurances of primary and sound healing. In past years I have covered the wound with a four-layer gauze dressing, sealing its edges only with collodion, so that the incision itself remained covered, but unsealed. Even with this method the gauze would become clogged with secretions in the obese patient. At the present the gauze roll is regarded as most satisfactory, though this may be sealed at the lower angle of the wound in order to keep the incision from being exposed to infection from below when the patient flexes her legs, thus causing the binder and other dressings to gape. Over any dressing there may be placed the ice-bag which relieves the pain in the wound but has no influence upon gas pains, as has been claimed by some.

In general hospital routine, the average laparotomy dressing is too abun-

dant. Only enough gauze should be used to assure the wound protection from contamination, never keeping it hot and moist. For the same reason wet antiseptic dressings, formerly advocated by certain experienced operators, have no place in the clean surgical field.

The superficial skin stitches are removed on the seventh or eighth day, the deeper retention ones on the tenth day. In the dressing that has been undisturbed the deeper layers of gauze are apt to be adherent along the edges of the wound and these are more readily freed if first soaked by hydrogen peroxid. The wound is sponged with alcohol, after removal of the stitches, and fresh dressings applied, with the scultetus binder over all.

Wound Infection.—One of the most annoying incidents of convalescence is infection of the wound. While slight infection is of relatively little importance it may lead to grave complications, and, in any event, it spoils what may be otherwise a technically perfect and therapeutically successful operation. It is due to contamination from septic tissues below, from the skin surface of the abdomen, or to technical faults at the time of operation, less often to imperfectly sterilized suture material. Imperfect hemostasis, giving rise to subcutaneous hematomata which are ideal culture-media, or the retention of broken-down fat globules or of serum may be the factors. In anemia, and in debilitated patients, as those suffering from carcinoma, tuberculosis, and sometimes lues, the process of healing is retarded and less resistance is offered to infection.

Stitch abscess appears, as a rule, on the sixth or eighth day, though it may not occur until after the stitches have been removed. The reaction is altogether local, often with not enough pain and soreness in the wound to attract attention. Sometimes the abscess is discovered at the first postoperative dressing. In other cases more than one stitch may be involved and, by the time discovered, a portion of the wound has become undermined by an accumulation of pus. The local symptoms are then more severe, with a rise of temperature and onset of pain and soreness locally. The possibility of stitch abscess should be borne in mind constantly and the slightest symptoms suggesting it must be investigated. Early recognition and treatment are necessary to prevent a slight infection from extending into a general suppuration.

When the entire abdominal wound breaks down, the abscess usually forms in the subcutaneous fat, the pus welling towards the surface between the stitches and forcing apart the edges of the wound to greater or less extent. Only rarely do the interrupted stitches uniting the fascia become involved, in which case the entire wound will open as far as the peritoneum. Even here the tendency is to point upward, and only in exceptional cases has rupture occurred into the peritoneal cavity. Symptoms of wound suppuration appear by the end of the first week or middle of the second. The temperature is irregular, septic in type, but higher than it should be at this stage of convalescence. The pulse is correspondingly accelerated. Discomfort in the wound is at first noticed; later it becomes acutely painful and tender. Inspection shows indurated wound edges which are fluctuant to palpation if

abscess formation has taken place. The dressings are apt to be stained or already soaked with the discharging material.

When suppuration has involved the fascial and muscular layers, symptoms of septicemia suddenly develop and these continue progressively until the wound discharges spontaneously or is treated. Septic peritonitis, with violent reaction and the speedy collapse of the patient, may ensue even without actual rupture of the peritoneum.

The integrity of the wound is impaired little or not at all, if the infectious process is limited to the subcutaneous space. On the contrary, danger of subsequent hernia naturally is present if the deeper lines of suture become involved. The length of the wound is of some importance also, as is the extent of lateral burrowing by the pus. As a rule these infections tend to clear up promptly when treated, the wound closing by granulation and cicatrization from below. An important factor, as well, in the prognosis is the general condition of the patient.

In the prophylaxis of wound infection more depends upon the technical details of operation than anything else. Certain of these have been emphasized in earlier sections of this volume and need but be mentioned again. The wound is prepared for closure at the time it is made, thus avoiding fresh bleeding when ready for closure. The wound edges are protected by folding the towels or sheets about them and including these in the grasp of the retractor blades. The wound is sufficiently long to accommodate the operator to the exigencies of the procedure being carried out, so that wound edges are not subjected to prolonged strain or undue pressure. Infected material is removed from the abdominal cavity in such a way as to leave the freshly incised walls uncontaminated.

Before closing, all bleeding points are securely ligated. Closure is affected by suturing in layers, in order not to leave dead spaces for the accumulation of blood, serum, or fat. Non-absorbable suture material is to be avoided if it must be buried. The skin edges are not continuously approximated, as when closed by subcuticular suture, because this prevents seepage from the wound. In thick abdominal walls suppuration is more liable to occur and greater care is exercised in order to prevent dead spaces. An extra layer of catgut may be run through the subcutaneous fat, and this fat must not be undercut too much, else the formation of a dead space is inevitable. Preferable to this is a slender drain of gutta percha or rubber tissue, or a few strands of silkworm gut, placed just beneath the skin and long enough to protrude at either end. After the skin stitches are in, the wound area is cleansed with alcohol, the retention sutures are tied over a gauze roll, and, over all, the dressings are applied.

The treatment of wound infection should be prompt and active. As soon as local inflammation is suspected the dressings are removed for inspection. If redness or induration is present, or if a stitch abscess has formed, hot wet dressings (of boric acid solution) are applied. These are kept on continuously until induration and excessive redness disappear. No sutures are removed, no drains inserted, and the wound is not probed. According to the experience

of Watkins, who has advocated this method of treatment for many years, no appreciable cavity is present at the site of suppuration and intra-abdominal and atmospheric pressure keep the discharging surfaces in relative apposition. When drainage ceases no open wound exists. Under this régime infected wounds heal more promptly, patients are less disturbed, and the abdominal wall is left much stronger than after the more energetic treatment formerly in vogue.

In those occasional cases in which the wound opens, to a greater or less extent throughout its length, the hot wet dressings are continued, and irrigation, if required at all, is best effected with the hypochlorite solutions. The wound may be poured full of dichloramin-T in solution, the dressings being changed twice daily, if the patient must remain on her back. Drains are unnecessary and if she is made to lie on the side or in the lateroprone position, discharging material will not be retained. As a rule Sims's position and hot wet dressings are all that are essential to speedy filling in and closure of the wound. With the appearance of clean granulations the adhesive straps are tightened and the gaping edges brought into approximation. If granulation tissue fills in in excess, it is curetted away and the skin margins, slightly undercut and trimmed, are brought together again as in the original closure.

When the suppurative focus is limited to the subcutaneous tissue, the patient's stay in bed need not be prolonged beyond the regular time demanded by her case. It is not, however, advisable to dismiss her from the hospital with a discharging wound.

Sinus tracts complicating the healing of abdominal wounds are rarely seen in these days when absorbable suture material is more extensively employed than formerly and more adequately prepared. The disuse of drainage, once so common, is another factor and, a third, careful peritonization of stumps and pedicle ligatures deep in the pelvis. These tracts in many respects resemble fistulous ones but there is absent the characteristic escape of feces or urine. A probe will pass to the bottom of the sinus where a somewhat extensive cavity may be determined or where other tracts lead off to other foci of infection. The spontaneous discharge of an infected non-absorbable suture is a matter of months and should not be awaited. Little is gained by probing or attempting to locate the offending suture with a snare.

In the certain absence of a foreign body a sinus might be effectively closed by infiltrating it with bismuth paste; otherwise expectant treatment is no longer the established method of dealing with these cases. Where the tract is extraperitoneal an incision is made through the old scar, the infected sinus is dissected out, or curetted free from necrotic tissue, and the wound allowed to close in from below.

Temporizing treatment of a sinus leading into the pelvis is usually futile, and operation is indicated. With a long probe introduced along the tract. the abdomen is cautiously opened and the adherent intestinal coils freed carefully until the bottom of the tract is located. Every effort is made to dissect the sinus throughout its entire extent before attempting removal, as it is extremely

difficult to extirpate such an area piecemeal. The greatest danger is in injury to the intestine which is invariably convoluted and plastered about the tract, and often nothing but a tubulated mass of adhesions. After removal of the sinus the abdomen should be closed without drainage if possible.

Urinary fistula, when due to ureteral injury, has been discussed in Section VI. Injury to the bladder usually closes spontaneously but in rare instances this fails and leaking persists. In the one case which I have seen of this sort, the failure of vesical closure was apparently due to a loop of the ileum which had become adherent to the parietal peritoneum and to the bladder just below the point of injury. In this case the abdomen was reopened, the bowel freed, the bladder mobilized and its wound repaired, and the abdomen then closed without drainage, although a retention catheter was passed through the urethra.

Fecal fistulæ, following abdominal operations, occur when there has been injury to the intestinal coats entailed in separating adhesions, when a portion of the intestinal wall has become necrotic from contact with an inflammatory mass, or when an injury has been repaired or anastomosis performed with subsequent leakage. The great majority of fistulæ follow the removal of pus-tubes, especially if these are tuberculous in nature and the adhesions, therefore, extremely dense, intimate, and extensive. Rarely, fistula is due to infection in the abdominal wall, a coil of intestine having become adherent beneath and later necrotic. Necrosis due to the pressure of drainage material, especially glass or rubber tubing, has been known also to result in a fistula.

The greater proportion of fistulæ involving the colon, invariably the sigmoid flexure or cecum, close spontaneously, as a rule. Closure is hastened if the patient is kept on a diet of concentrated foods, operation rarely becoming necessary. The small intestine adherent to the abdominal wall produces a fistula of more serious import. The contents being liquid and more irritating to the skin, spontaneous closure is delayed, though it does take place. If the upper portion of the bowel is involved, general emaciation due to loss of food increases the gravity of the situation.

As soon as the patient's condition makes it possible, a permanent fistula should be closed. As a rule this is best done not later than three months after the original operation by which time the scar is well organized and recent granulation tissue no longer present. Incision is made parallel to the old wound but not too close, in order to avoid adhesions, if possible, upon opening the peritoneum. From within the adherent loop of bowel is then carefully freed and the extent of the injury to its coat investigated. If the hole is a small one it is closed by a purse-string of fine catgut. Sometimes the wound is linear and is then repaired by an over-and-over whip-stitch, care being taken to close it in such a way as not to restrict unduly the lumen of the bowel. Resection with end-to-end or lateral anastomosis is rarely indicated —only when there is extensive loss of continuity of the gut, as in dense infiltration, gangrene, or obstruction. Lateral anastomosis without resection,

merely short-circuiting the fistula, or colostomy above the fistula, are almost equally extensive procedures without certainty of cure.

HEMORRHAGE AND SHOCK

Hemorrhage.—Following abdominal operation hemorrhage may be continuous, having never entirely ceased, and is then due to imperfect hemostasis. Oftener the escape of blood is secondary, coming on some time after completion of the operation, being then due usually to the slipping or breaking of a ligature. It has also occurred after the withdrawal of a drain, adhesions being disturbed and a vessel opened. With the perfected technic of modern surgery hemorrhage has become one of the rare complications. While the bleeding may come from any vessel it is most frequently the ovarian artery that is involved, the infundibulopelvic portion of the broad ligament having slipped from the grasp of its ligature.

In the management of the case one of the most difficult problems is the differential recognition between hemorrhage and shock. The clinical signs are much alike, though the physiology of acute anemia and shock are not the same. Except for securing the bleeding vessel the treatment is the same, but this one exception is all important, and no greater error can be made than to treat active hemorrhage on the basis of shock alone. This differentiation may be outlined as follows:

Hemorrhage	*Shock*
1. Signs and symptoms date from operation, collapse where general condition and pulse have been unsatisfactory.	1. Signs and symptoms come on gradually some hours after operation, following recovery from anesthetic.
2. Regardless of previous condition of patient.	2. Oftenest in patients previously weak and exhausted, with loss of weight.
3. Regardless of character of operation.	3. Operation prolonged, especially if much trauma or loss of blood.
4. Face white and pinched; skin pale, cold and clammy; mucous membranes blanched.	4. Face pallid and pinched; skin blanched, cold and clammy; mucous membranes blanched.
5. Restlessness, tossing head and arms; anxious and worried; eyes staring, pupils dilated.	5. No restlessness, apathetic; lying quietly on back; eyes closed, reflex absent.
6. Recurrent syncope; faintness and ringing in ears.	6. Recurrence of syncope rare; no complaint of faintness.
7. Thirst.	7. No thirst.
8. Pulse rapid, weak and thready; artery soft or not palpable.	8. Pulse rapid and small, not easily compressible.
9. Respiration labored, deep, gasping; marked air-hunger.	9. Respiration rapid and shallow; no air-hunger.
10. Temperature usually subnormal.	10. Temperature low, may be subnormal.
11. Visual disturbance; may be loss of sight.	11. No visual disturbance.

Hemorrhage	*Shock*
12. Fluid in flanks or pouch of Douglas may be demonstrable; may be tenderness or rigidity.	12. No abdominal pain; abdomen soft; no signs of fluid in flanks or in pouch of Douglas.
13. Superficial veins collapsed. (Noted in transfusion.)	13. Superficial veins full of blood.
14. Moderate leukocytosis; hemoglobin lessened, but not at first; coagulability of blood increased.	14. Blood findings negative; hemoglobin unchanged.
15. General stimulating treatment alone of no avail and may increase hemorrhage.	15. General stimulating treatment improves the pulse.

The condition of anemia rapidly progresses, if not promptly treated, and in the severer cases death may be preceded by delirium or convulsions. Where the hemorrhage is oozing in character the course is much slower and the symptoms modified accordingly. In drainage cases red blood or serum in quantity may escape from the wound.

The prognosis depends upon the preoperative condition of the patient, upon the amount of blood lost during the operation and upon the present degree of hemorrhage. Until the bleeding point is found and ligated there can be no assurance of safety. Where anemia is marked, recovery will be slow and several weeks or months may be required before the patient is restored to health. In such cases infection plays an important part and is a complication to be feared. With vitality lowered by loss of blood the patient may succumb to a degree of sepsis that might otherwise be easily combated.

The prevention of postoperative hemorrhage is largely a matter of technic and certain principles emphasized in previous sections are aimed at this accident. Too great care cannot be exercised in placing ligatures, and those placed about known blood-vessels should be passed through surrounding tissues and not merely tied below a clamp. Whether operating by the separate ligature method, such as has been described in my volume, or by the clamp and suture method, enough stump must be left to insure against slipping under tension. Tissues held by clamps and whip-stitched are more apt to be under tension when released than are those in which the vessels are tied directly by separate ligatures. The avoidance of suture material that is frayed and imperfect or that lacks the tensile strength sufficient for the intended purpose is, of course, of first importance. Finally, in peritonization, whereby the ligatures are buried under folds of peritoneum, the ultimate precaution is taken. This compels a close inspection of every raw edge or surface and should give assurance that even moderate oozing has been stopped.

Postoperative hemorrhage demands active treatment without delay. There have been those who speak of treating a slight internal hemorrhage by elevating the pelvis, keeping the patient quiet and stopping all stimulants for twenty-four hours, but experience does not justify one in accepting such a chance. The only treatment for a bleeding vessel is to ligate it, or, at least, to secure it with a clamp. This requires opening the abdomen and exposing the point

of hemorrhage so that the vessel can be tied. This is done without delay, and the peritoneal cavity is sponged clean only if the patient's condition permits. The abdomen is then filled with warm normal salt solution and closed. The patient is kept warm on the operating table and in the Trendelenburg position until ready to be returned to bed.

Further treatment is much the same as for shock. Thromboplastic agents are indicated in those cases only in which the coagulability of the blood is not decreased. Obviously, stimulants, and particularly saline transfusion, should be omitted until the hemorrhage is checked. As soon as this has been accomplished, however, and while the abdomen is being closed, assistants may administer the saline solution under the breasts. When conditions are not so desperate, subcutaneous transfusion is usually sufficient and this is supplemented, upon the patient's return to bed, by a retention enema of salt solution and brandy per rectum. If the patient's condition is grave venous transfusion of the saline, or of blood, may be deemed necessary but the administration of this must await closure of the abdomen.

Strychnia, nitroglycerin and atropin, or camphorated oil are the cardiac stimulants which may be given hypodermatically while the patient is still on the table, and these are continued, too, as indicated, after her return to bed. Here she is kept warm by blankets and hot-water bags, the foot of the bed is elevated, and further treatment consists of a repetition of the cardiac stimulants, of the salt solution, and, as soon as it can be retained, of highly concentrated liquid foods. As a rule, 6 ounces of the normal saline every four hours is sufficient during the next two days. Strychnia ($\frac{1}{20}$ Gr.) may be given every two hours for a time, the doses being gradually decreased and more widely separated as conditions warrant. Atropin and nitroglycerin are also repeated as they may be indicated. Egg-white, beef-tea, meat juice and grape alcohol are the foods of greatest immediate value. Convalescence is apt to be prolonged and a diet of rich, nutritious foods, with Blaud's mass, is continued for some months.

Following vaginal operations, hemorrhage may occur for the reasons already given, but here the escape of blood is through the vaginal canal and hence evident. It may, however, be profuse before it is recognized. After plastic work, bleeding is most frequent from vessels cut during amputation of the cervix, or from those in the posterior vaginal wall. The premature absorption of catgut may be responsible, but more often the hemorrhage is due to imperfect hemostasis and careless suturing. While the uterus is held down by traction, hemorrhage does not occur and the stitches are introduced. When traction is relieved and the uterus allowed to relax, its vessels are no longer under tension and may then bleed quite freely. The hemorrhage is, therefore, primary or secondary. The former should be discovered speedily and checked, but the latter may take place any time during the next three or four weeks.

The vaginal canal is exposed by a speculum, it is freed from the accumulated blood, and the point of bleeding is then sought. If a vessel is spurting it is caught and ligated. Venous oozing may be controlled by sutures but in many

cases packing with gauze is sufficient. Over the speculum, or with the fingers as a guide, a strip of sterile gauze is packed in tightly, particularly in the vaults and against the vaginal walls. A perineal dressing of gauze held in place by a T-binder is then applied. The pack is left in place for forty-eight hours.

Shock.—Despite the extensive literature pertaining to the subject there is still a lack of understanding as to the exact nature of the phenomenon known as shock. Bayliss has defined traumatic surgical or secondary shock as a state of collapse associated with low blood-pressure, producing a deficient circulation of blood and depriving the tissues of the necessary supply of oxygen. Primary shock, or collapse, is apparently of nervous origin, analogous to fainting, and differs only in severity and length of duration. Others conceive of shock as arising primarily from a reflex vascular contraction extending from the periphery to the center. On this basis is explained the tensely contracted vessels as evidenced by the blanched appearance of the skin, the collapsed condition of the patient, the fall in temperature and death, when death occurs. The sweat-glands secrete profusely, their action not being interfered with by the bloodless condition of the skin. The starvation of tissue is held to be a sufficient cause of the decrease in alkali reserve, or of actual alkalosis, this being the result of the general condition rather than a cause.

Regardless of the many theories expressed, it has gradually come to be realized that the chief factor in shock is a deficiency in the volume of blood in circulation. Because the blood is probably held up somewhere in dilated areas of the vascular system, it has been assumed that the region in question is the capillary field, but Malcolm has suggested that, if not in the arteries or veins, the lost blood may have mainly escaped from its vessels altogether.

In consideration of postoperative shock, three generally accepted factors predominate: First, when operations are prolonged; second, when there has occurred a considerable loss of blood; third, when trauma has been extensive. Crile has emphasized the point that there is little shock in the absence of perforation of the hollow viscera and hemorrhage, but if there is perforation or hemorrhage, or both, shock results. In a broader study of the subject certain other points become evident. Shock following burns is of a septic nature. Likewise the resemblance between shock, peritonitis, hemorrhage, fat embolism and gas gangrene is often strikingly suggestive.

Two stages of wound shock have been described. The first stage occurs immediately on receipt of the injury and is similar to an exaggerated fainting. Consciousness is retained but speech is weak. Commands are understood but not always obeyed. Heart tones are less audible, the peripheral pulse is small but tense, and the blood-pressure is undisturbed or slightly raised. Respiration is regular but shallow. The second stage occurs after partial recovery and is characterized by collapse or relaxation of the vascular system. The blood-pressure sinks and the consequences of this are the most general and obvious signs of the condition. The sensory apparatus remains clear and in the final stage the entire pathologic picture is that of a severe vascular crisis.

The symptoms of shock have been outlined in the paragraphs pertaining

to hemorrhage. As a rule they follow the operation closely, the patient's condition having never been satisfactory. Coming on a few hours after operation, the signs are much more apt to indicate hemorrhage. The longer reaction is delayed after collapse the worse the prognosis. As a rule improvement is slow but steady and after a few hours the patient is no longer in danger, but the prognosis is not good if reaction is delayed over twelve hours. Severe vomiting tends to prolong recovery or to prevent it. Delirium intervening is a bad sign and, if accompanied by low temperature and a thin rapid pulse, recovery is improbable.

The prophylaxis of shock need not be considered at length. To shorten the duration of operation, to avoid undue handling of viscera and traumatizing of tissues, and to prevent the immoderate loss of blood have long been three of the cardinal principles of modern surgery. They constitute important technical details and have been discussed at length in previous sections of my volume.

Anesthesia continues to be a factor in discussing the prevention of shock but improved methods of administration, by which ether toxemia is being more and more eliminated, has reduced its importance. The patient must be kept warm during operation, chilling and wetting being avoided. If, at the close of operation, the pulse is of none too good quality the abdomen is filled with hot normal saline solution, as after hemorrhage.

Shock is treated energetically and without delay. The three essentials are to keep the heart going, to keep the patient warm and to fill up the circulation. The foot of the bed is elevated, the patient is wrapped in hot blankets, and hot-water bags or pads are placed about the trunk and legs. The extremities are bandaged in order to keep as much blood as possible nearer the vital centers. All drugs are given by hypodermatic injection; strychnia sulphate ($\frac{1}{20}$ Gr.) and nitroglycerin ($\frac{1}{100}$ Gr.), the former being repeated every hour until the patient is better. The nitroglycerin is repeated with atropin sulphate ($\frac{1}{150}$ Gr.) every four hours. Digitalin ($\frac{1}{50}$ Gr.) may be given with the strychnia, and morphin sulphate ($\frac{1}{8}$ Gr.) is indicated if the patient is restless. When respiration is labored, oxygen is given by inhalation.

Normal salt solution is prepared, meanwhile, and 1 pint, with an ounce of brandy, is given by high enema. This may contain, also, 10 minims of adrenalin solution (1 : 2000) with the hope of increasing the blood-pressure. The rectal saline alone is continued every two to four hours, according to conditions. If blood has been lost in excess, salt solution by hypodermoclysis, preferably beneath the breasts, is sufficient in the majority of cases. But when the patient does not rally, or improves slowly, venous transfusion is the most certain resort. After she has shown definite power of resorption, stimulating rectal enemata of coffee are sufficient until food may be given to best advantage by mouth. As soon as reaction is well established this feeding consists of frequent small amounts of concentrated liquids. The patient is kept quiet and nursed guardedly. Gradually the foot of the bed is lowered, and recovery is usually rapid after the condition of shock has once passed.

Venous infusion of physiologic salt solution is an extremely valuable

method of treatment where there has been an immoderate loss of blood. The ideal treatment in this kind of shock would be an infusion of fresh blood-serum with all its proteins. As such a fluid is virtually impossible to obtain, an attempt has been made to replace blood-serum by Locke's solution with the addition of gum arabic. The quantity of blood lost is first replaced by a saline or glucose solution. The two solutions are prepared and sterilized separately and mixed as required for use. The maximum injection of the Locke and gum solution should not exceed 150 c.c. This method has proved to be particularly effective in aiding the reëstablishment of the blood-pressure.

Owing to its now well-established ability to oxidize glucose, insulin has been employed in association with the transfusion of glucose solution. The results are so much better that the combination of these two agents is regarded by some as specific in the treatment of surgical shock. According to Fisher and Snell, from 500 c.c. to 1000 c.c. of a 10 per cent sterile solution of glucose is given intravenously, the material being allowed to enter the vein so slowly that an hour is required from the beginning to the end of its administration. The insulin is given subcutaneously, preferably in two equal doses, the first half five minutes after the beginning and the remainder at the end of the glucose administration.

Every clinician of extensive experience has his own preferred method of blood transfusion. The result is that a number of such methods, varying widely in technic, have been brought into use. Like Lewisohn, my personal experience with wound shock has been too limited to warrant a definite opinion on this subject. The relative values of the various methods have been summed up by Graham as follows:

Direct Transfusion.—(*a*) The chances of thrombosis and embolism are reduced to a minimum. (*b*) The operation is more difficult to perform than indirect transfusion. (*c*) The use of the radial artery is a greater sacrifice for the donor than a vein. (*d*) The radial artery is occasionally too small for the purpose. (*e*) The amount of blood cannot be exactly measured.

Indirect Transfusion.—By the use of syringes and cannulæ, with or without the two-way stopcock: (*a*) The operation is simpler than direct transfusion. (*b*) The method demands less sacrifice from the donor. (*c*) The operation can be more quickly performed than direct transfusion, or any other method. (*d*) The amount of blood transfused is known. (*e*) The risks of clotting in the apparatus can be obviated. (*f*) Simple instruments can be improvised for the syringe method. (*g*) The patient and donor must be brought into contact.

Citrate Method.—(*a*) Sodium citrate mixed with blood in the proportion of 0.2 per cent maintains the blood fluid for several days. In practice it is advisable to use a stronger proportion of citrate (0.38 per cent). (*b*) Citrated blood can be safely used several hours after preparation. (*c*) The withdrawal and preparation of blood for transfusion is simple. (*d*) An incision is not required to expose the donor's vein. (*e*) There is a greater tendency to reaction than after transfusion with unmodified blood. (*f*) When a reaction occurs it does not affect the patient seriously. (*g*) Large quantities

of blood can be transfused without fear of toxic action on the part of the citrate. (*h*) Results in shock and hemorrhage are as satisfactory as with unmodified blood. (*i*) The coagulation time of the blood is temporarily shortened. (*j*) There is no risk of increasing the tendency to hemorrhage. (*k*) Unmodified blood should be preferred to the citrated blood in pernicious anemia and other blood diseases.

As stated by Lewisohn, in acute sepsis, acute leukemia, and inoperable cancer blood transfusion is useless and not without danger. Blood-grouping must always be carried out before a transfusion and it must be remembered with regard to the selection of donors, that a recipient may change her blood-group after a transfusion, so that she must be tested again before a second transfusion is given.

In cases of secondary anemia, Ward has advocated the preoperative transfusion of blood. He found that 500 c.c. of blood are sufficient to bring the patient's condition up to the limit of safety for operation. The direct method is used and particular care is taken in matching the donor's and recipient's blood.

Autotransfusion for hemorrhage, as in the treatment of ectopic pregnancy, has been advocated in recent years in a few clinics, chiefly in Germany. In this method the blood is recovered from the abdominal cavity, filtered through gauze and diluted with an equal amount of physiologic salt solution. It is then reinfused into a vein. As much as 300 c.c. to 1000 c.c. of the woman's own blood have been returned to her circulation in this way. According to Burch, who used this method in association with an operation for splenectomy, the addition of sodium citrate is not essential. The reaction appears to be about the same as that following the citrate method. Fatality following the transfusion of autogenous blood has been reported in a few cases. In one such described by Grossmann death was due to uremia on the sixth day after operation. The danger is due to some biological reaction having changed the free blood in the abdominal cavity. The surgeon must decide at the time of operation and must be certain that the blood is sufficiently fresh and unchanged. If even a part of it is decomposed it cannot be used. The question of a preëxisting idiosyncrasy dependent upon a constitutional condition, such as paroxysmal hemoglobinemia, also comes up for consideration.

PERITONITIS

Every operation involving structures within the abdominal cavity is followed by a reaction in some degree on the part of the peritoneum whereby wounds are healed, raw areas covered over and suture material encapsulated and absorbed. Plastic peritonitis, also called traumatic or adhesive, is, therefore, a regenerative process, to be expected and desired but of unfortunate influence when so extensive as to interfere with visceral function. Postoperative rise of temperature, not due to infection, is ascribed to the resorption of fibrin-ferment and other products of tissue metabolism. The extent and severity of this reaction depends upon the amount of exposure and degree of

trauma produced chiefly to the small intestine. The lymph exudate poured out agglutinates the various peritoneal folds lying in close apposition, producing adhesions which later become absorbed or, in severer cases, remain permanently. The postoperative increase in temperature is rarely more than 1½ or 2 degrees above normal. The pulse is quickened, but full and soft. Local pain and tenderness are present and the lower abdomen is often rigid, but above the umbilicus it is soft and elastic. There is no considerable increase in the leukocyte count. On the second day the symptoms subside and after the third day, in the absence of septic infection, satisfactory convalescence is established.

When these signs and symptoms are more severe there is some degree of tympany, with accompanying gas pains and a higher rise in temperature. The general condition of the patient is good, however, and the suffering due more to persistent emesis and intestinal distention. If the operation has been more than ordinarily traumatic, involving much handling of the intestine and breaking up of extensive adhesions, greater distress is to be expected. In such cases, if the intestine is quiet after operation, causing no distress, the adhesions forming are all the more apt to become permanent.

Postoperative peritoneal reaction due to the presence of infecting microorganisms is known as peritonitis. This is diffuse and localized.

1. Diffuse peritonitis is characterized by symptoms usually continuous with those of the adhesive type and appear not later than seventy-two hours. During the second or third day the pulse gradually increases in rate to 100 or 120 and it is quick, small and tense. The temperature has been above normal from the first and rises steadily to 102.5° F. and may reach 104° F. Vomiting becomes aggravated and may be continuous with that due to the anesthetic. At first small in amount, it becomes more profuse and takes on a dark brown or green color. Sharp, recurrent, griping pains appear in the lower abdomen and these become intense. In the meantime tympanites develops as a result of the intestinal paralysis, the abdomen becomes distended and its wall is rigid. This results in limited diaphragmatic descent, so that respiration is shallow and rapid, becoming sometimes altogether thoracic. Intestinal stasis is often marked, the bowels not responding to colonic flushings. The patient becomes restless and sleeps poorly. Leukocytosis shows a rapid and marked increase. As the condition grows worse the gastric contents become fecal in character, the result of reverse peristalsis, the face takes on a pinched, anxious expression, retching and vomiting are excessive, and the skin is cold and clammy. Albumin and casts often appear in the urine and leukocytosis shows a rapid decline.

"Septic peritonitis" is a form of reaction characterized by these more marked symptoms from the beginning, and is usually found in that patient only whose vitality is lowered before operation. She shows great depression within a few hours after operation, the pulse is rapid and thin, imperceptible at times, and the temperature variable, ranging from 99° F. to 105° F., or it may be subnormal. The abdominal wall is hard and spastic, often with no extreme distention. Collapse is evident, and there is relatively little pain.

The leukocyte count shows little or no increase and the polymorphonuclear cells are especially wanting, an evidence of lowered resistance. This form of peritonitis is not easily distinguished from shock or internal hemorrhage.

Diffuse peritonitis is an unusual complication after gynecological operations, but is always regarded as one of the gravest. The prognosis varies with the degree of prostration, but has changed for the better with modern methods of treatment. This is not different in any particular from that employed in peritonitis due to such commoner causes as perforation of peptic or enteric ulcer, of appendicitis, or of cholecystitis. Any treatment instituted, however, must be early and this depends upon early recognition of the condition present, a factor of first importance. No one method is sufficient in itself but the following four procedures are to be undertaken without delay.

(*a*) *Drainage.*—The wound, at least the lower portion of it, is reopened, the accumulated purulent fluid allowed to escape and a drain is introduced, extending it into the pelvis. This drain should be of good size, either a rubber tube, fenestrated, or a gauze strip inclosed in rubber or gutta percha tissue, the cigarette drain. Irrigation at this time should not be attempted.

(*b*) *Fowler's Position.*—The head of the bed is elevated and the patient kept continuously in this position. In order to keep her from repeatedly slipping down a padded board may be fixed transversely across the bed just below the buttocks against which she rests with legs flexed. As soon as her condition permits she may lie on her side or even in the lateroprone attitude.

(*c*) *Proctoclysis.*—Physiologic salt solution, at a temperature of 100° F. is allowed to flow into the rectum in large quantities. The flow may be continuous or interrupted, and is best introduced through a flexible colon tube, not so large as to prevent the escape of gas. By this method from 500 c.c. to 1000 c.c. of solution will be absorbed every hour, according to the needs of the individual case. Many surgeons prefer the interrupted method, by which 6 ounces of the solution are injected slowly above the sigmoid colon, a quantity which is readily retained and may be given as often as every hour. In cases of but moderate severity, 6 ounces every four hours are enough.

(*d*) *Stimulation.*—This is afforded in the first place, by the saline solution, to which an ounce of brandy may be added. In addition the patient is given strychnia, and such other medication as has been outlined in the treatment of shock and hemorrhage.

Other measures are employed according to symptoms or individual peculiarities of the case. Eserin sulphate is preferred by some to alleviate distention; others advocate pituitrin. I have not found eserin of value and disapprove of pituitrin in cases in which the bowel is directly involved. Morphin or heroin are required in doses sufficient to alleviate pain.

As a routine in many clinics an ice-coil is kept on the abdomen as long as it is tense and rigid. Others prefer hot packs, turpentine stupes and like methods of applying heat. Crile spreads vast hot packs over the entire abdomen, extending them well down over the sides. He also uses a 5 per cent sodium bicarbonate solution, with 5 per cent glucose, by rectal drip, instead of salt solution.

Gastric lavage is most efficient in relieving nausea and vomiting, and is repeated as indicated. This is not always well tolerated in desperate cases but where dilatation of the stomach coexists, lavage must not be omitted. Cool or tepid sponge baths are ordered when the temperature persists at 103° F. for any length of time. As soon as the stomach becomes quiet, liquid or soft foods are given. Retention and nutrient enemata are then stopped and colonic flushings for evacuation are begun.

As in the treatment of postoperative vomiting and of shock, the use of glucose solution combined with insulin has been more recently employed to check the incessant vomiting of peritonitis. A sterile solution of glucose, 10 per cent to 15 per cent in strength, is administered intravenously. Five hundred to 2000 c.c. may be given, depending upon the severity of the condition. This is allowed to flow into the vein so slowly that at least an hour is required; according to Fisher, from two to four hours are better. For every 3 Gm. of glucose, 1 unit of U 20 insulin is injected, the total amount of insulin being divided into two equal doses. One part is given fifteen minutes after the flow of glucose has been started and the other half at the end of its administration. Fluid by rectum may be given at the same time in order to overcome the tendency of glucose to deplete the body of fluids. As long as glucose appears in the urine there is no danger of an insulin reaction, and when this does occur it is readily counteracted by adrenalin.

2. Localized Peritonitis.—This form of infection, while not a common complication, more frequently than any other follows gynecological operations. When localized peritonitis has been a preoperative factor, as in that associated with pyosalpingitis, it is not surprising if there should be some such reaction following enucleation of the diseased tubes. The infected area tends to remain within the limits of its walls of inflammatory exudate, but such is not always the case. Infection of a stump, or of its ligature or a line of suture also gives rise to local reaction which is nearly always held within bounds. The evacuation of a pelvic hematocele may leave a focus for infection and, finally, infection may be secondary to suppuration of the abdominal or vaginal wound. While usually single, more than one focus may develop.

The symptoms are usually somewhat later, and are less marked, than with diffuse peritonitis. A sudden rise in temperature, with increased pulse and leukocytosis, appears sometime between the fourth and sixth day, or even as late as the end of the first week. The fever fluctuates between normal and 101° F. and 103° F. Pain is experienced during this time and is fairly well localized on one or the other side. Moderate distention is present with tenderness over the painful region. A slow course is the rule, with no tendency toward collapse. The bowels are difficult to keep open and pain is severe with evacuation or the introduction of the enema, though relief is experienced upon its evacuation and the expulsion of gas. Tympany increases and the signs come to be those of partial intestinal obstruction, with nausea and vomiting, and sharp, colicky pain. A swelling may become evident in the lower abdomen, or deeper in the pelvis on vaginal examination, and the condition may go on

to general peritonitis. Relief by spontaneous discharge of pus through the abdominal or vaginal wound is rare.

Recovery is speedy following prompt treatment and this consists of evacuation of the abscess. The lower end of the wound is opened, the abscess located, its adhesions broken up and a tube inserted. In case the localization is well to one side, a better method is to insert the tube through a lateral stab-wound, after which the old incision is again closed. Localization deep in the pouch of Douglas is not frequent, but occasionally this occurs and evacuation is then most readily effected by posterior colpoceliotomy. In rare instances through-and-through drainage is established before all foci are discharged. The insertion of a tube in vaginal drainage is unnecessary, as has been emphasized in a previous section where the technic of posterior colpotomy has been described in detail.

Exploration at the time of this secondary operation is limited to examination of the ileum. If a loop of this structure has become adherent, or kinked, it is carefully freed and pushed aside. Localized adhesions along the course of the small bowel are always provocative of more serious immediate and ultimate trouble than are general adhesions.

After evacuation of the abscess the patient is again placed in Fowler's position and hot wet dressings applied to the abdomen. The colon tube and rectal enemata are used for the relief of gas pains and in other respects the further treatment is the same as in diffuse peritonitis.

INTESTINAL OBSTRUCTION AND PARESIS

What has been stated regarding involvement of the ileum in localized peritonitis becomes of first importance in intestinal obstruction as a complication secondary to pelvic surgery. In the absence of diverticulitis or malignant disease it may be said of the large bowel that it is never the seat of obstruction. The aim, therefore, of all efforts at peritonization is to leave peritoneal surfaces in such condition that the lower folds of the ileum may not become kinked or adherent. Hence in clean cases that remain clean intestinal obstruction does not develop. Infection and peritoneal inflammatory reaction, then, become the essentials in the production of adhesions involving the ileum and producing such kinking or paralysis as results in obstruction.

Intestinal obstruction as a postoperative phenomenon is classified as (1) organic or mechanical and (2) paralytic.

1. Organic obstruction is due to the various conditions which follow intraperitoneal procedures or which result from pathological conditions existing prior to operation. These factors are nearly always infectious in character and cause the formation of adhesions.

(*a*) The intestine becomes adherent to other structures. It may have been adherent to the pelvic inflammatory mass at the time of operation, requiring its separation. Or an intact coil becomes adherent to some surface which is raw, such as a pedicle stump, an omental stump, denuded areas on other gut loops, on the pelvic walls, or to the line of closure in the abdominal incision.

(*b*) The formation of bands, stretching from one structure to another, may involve the bowel directly, or form a bridge beneath which it slips and becomes strangulated. These bands may represent lighter adhesions that have later stretched out or they are due to lymph exudate poured out during the stage of plastic peritonitis. Or the omentum becomes fixed at one or more points, and an intestinal loop is entangled about it. In other cases bands are created artificially, as in certain types of ligamentopexy or ventral suspension of the uterus.

(*c*) An intestinal loop may force its way through some orifice and become strangulated. This accident has taken place through a hole in the mesentery or omentum or through an opening made in the broad ligament in the course of operation. The intestine may have been looped already by adhesions or by lateral anastomosis without resection. A loop of ileum has protruded into the vaginal vault after hysterectomy and, again, it has been found to have slipped between the peritoneal edges of the abdominal wound. In one instance I discovered the intestine adherent in the subcutaneous fat, beneath an old, thinned-out, laparotomy scar. The inclusion of the bowel in a ligature or stitch has given rise, more than once, to peritonitis and obstruction.

(*d*) A rare occurrence as a postoperative accident is volvulus, produced by the revolution of a single coil of intestine about its mesentery or by the twisting together of two separate coils. A flatulent coil, or one loaded with feces, presents the most favorable opportunity for twisting.

2. Paralytic ileus may be an end-result of organic obstruction or it may represent a temporary paralysis, a reflex action through the plexus of Auerbach and Meissner, as a result of manipulation and trauma to the visceral peritoneum. In the first instance the sequence of events consists of the fixing of the bowel by adhesions in a kinked position, the stoppage of the onward peristaltic movement, the production of ptomains in the bowel contents, and the poisoning of the patient and paralysis of the bowel by these toxic products. The paresis is often confined to a limited section of the intestine, usually its lower portion, and is, therefore, a local rather than a general involvement. In the second instance the condition is not so much an obstruction as a true stasis, the inability of the bowel to propel its contents onward, and has been termed aperistalsis. Here the plexus of Auerbach, the motor apparatus in the intestinal wall, does not respond to stimuli. The influence of ptomains produced in the arrested bowel contents has been brought into question but they undoubtedly form an important factor.

Most acute obstructions occur between the third and sixth day; they are delayed longer when due to the contraction of bands of adhesions, but appear within a few hours if the result of some accident of operation. Vomiting is spontaneous, early, and more or less constant and persistent. This is accompanied by increasing constipation and abdominal distention. The pulse is rapid and the temperature tends to rise as the vomiting continues. The vomiting is apt to become projectile and of large quantity regardless of the quantity of fluid intake, and, as the distention increases, the vomitus changes to a dark brown, sour-smelling fluid. Eventually, as reverse peristalsis develops, the

ejected material is definitely fecal. In paresis the vomiting is absent at first and may not occur in moderate or mild cases, but in the severer forms, occurring later, emesis develops in all respects as in mechanical ileus.

Some flatus and fecal material is expelled early in obstruction but this soon ceases. After obstruction is complete there is no further escape of feces and enemata either return clear or are not retained. If the point of obstruction is low, the colon tube cannot be passed. In paretic ileus, on the contrary, the tube is readily admitted, the enema is retained and often is not returned. An intermittent discharge of mucus with griping pain and tenesmus has been described by some as a feature of colonic obstruction.

The extent of abdominal distention depends upon the degree of occlusion, its location, and, at least in part, upon the condition of the abdominal wall. At first distention is local and more marked at a certain point. In paresis the upper portion of the small intestine presents the greatest protrusion, whereas sigmoid obstruction is evident early by distention of the left lower abdomen. If the abdominal wall is a thick firm one this localization is not evident; if it is thin and relaxed, or diastatic, the distention is more rapid and more prominent, and the peristaltic wave can be seen. Rigidity and tympany are pronounced but tenderness is not marked prior to the development of peritonitis. Rigidity is often absent in the paretic form.

The temperature is rarely high, often not over 100° F., but the pulse is rapid early, remains so constantly, and is usually weak and feeble. As collapse occurs the temperature becomes subnormal, and in the paretic variety of ileus is never elevated.

Differential diagnosis rests between the two varieties of ileus and ileus and peritonitis. Appearing, as they may, during the first postoperative week, differentiation may be impossible. Traumatic peritonitis may exist from the closure of the abdomen and intestinal occlusion result from it. Or, secondary to obstruction, septic peritonitis may appear. In either event the diagnosis is obscure. Two of the three conditions may coexist.

When once the condition of mechanical obstruction is recognized treatment must be definite and without delay. Procrastination always results in peritonitis. The abdominal wound is reopened and the point of constriction sought. Here the obstructing bands of adhesions are cut or a volvulus is untwisted. If distention is found in the region of the ileocecal valve the obstruction is further down, often in the sigmoid flexure or rectum. The collapsed portion of the ileum is usually hidden from view by the distended portion of the ileum overlying it, so that, instead of following the collapsed bowel upward one may have to follow the distended loops downward. In any event, as little handling of the intestine as possible, as little surgery as possible, is the best rule to follow. Results depend more upon the condition of the patient, on the length of time which has elapsed since the onset of symptoms and on the degree of involvement of the bowel wall than on the nature of the operation. Every possible delay in active treatment is to be avoided and chances of recovery are always enhanced if surgical interference is undertaken before definite peritonitis has developed.

When the gut wall is so seriously impaired that it is torn in freeing the adherent loop, or if the portion involved has become gangrenous, or if the obstructed point cannot be found, the patient's condition is always such as to make any extended procedure, such as resection and anastomosis, dangerous. By this time peritonitis is advanced, the patient is in shock, or in danger of shock, and dehydration of tissues is progressive. Under such circumstances it is wiser to establish drainage for the distended bowel by uniting the first distended loop to the margins of the incision and opening it. This may mean colostomy, with the sigmoid flexure on the left, or cecostomy on the right. More often the ileum is the distended portion of bowel that is accessible, and enterostomy is done rapidly, without disturbing the adhesions. Where choice is permitted this opening is made as close as possible to the obstruction and, of course, above it. The simplest method consists of stitching the exposed bowel wall directly to the parietal peritoneum, after which the intestine is opened longitudinally and the free edges of this incision are stitched in turn to the skin edges of the abdominal wound. This permits drainage immediately and relieves distention.

Drainage from the discharging bowel by a tube is preferred by many, since this method is more apt to insure spontaneous closure of the fistulous tract after the patient has recovered. The presenting coil of ileum is surrounded with gauze and a purse-string suture of catgut is applied. The bowel is then punctured with the cautery, a rubber tube is passed through the hole thus made and the suture is tied about it. A second purse-string suture is then passed and tied again about the tube, this suture passing through the tube wall at one point in order to keep the intestine from slipping away. The omentum is secured, if possible, about the tube and between the bowel and abdominal wall. This prevents the intestine from directly adhering to the parietal peritoneum after the tube is withdrawn and hence closure is more apt to be spontaneous.

In paretic obstruction the distention is more frequently in the upper portion of the small intestine and high stasis is more serious than low. Treatment, again, must be prompt and, as a rule, surgery is unnecessary. No purgatives are given and no food after the patient has begun to vomit. Instead, the treatment consists of gastric lavage and retention enemata, or proctoclysis by the drip method. Pituitrin here finds its best indication in intestinal obstruction, and in many cases it appears to be of definite value in aiding the restoration of tone and peristalsis.

If, in spite of this treatment, the distention persists and the patient's condition is seen to be growing steadily worse the upper intestine is drained by enterostomy. The incision is made well above and to the left of the umbilicus. The first distended loop of bowel presenting is picked up and tapped. The presence of pancreatic secretion in the large quantity of brown fluid which has usually collected is evidence that the duodenum has been opened. Again, no attempt at exploration is necessary or desirable. Drainage is continued until the paresis has entirely subsided and this is hastened by the introduction of a small tube into either side of the loop. Relief from the

distention requires several hours, after which physiologic saline solution in small quantities is allowed to run in. The opening thus made does not tend to close spontaneously and operation for anastomosis is therefore carried out as soon as the patient's condition makes such a procedure feasible.

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